The **DEETER Group®**

deeterflow®

Automatic Liquid Dispenser
Table of Contents

1. Introduction ........................................................................................................................................ 3
2. Installation ........................................................................................................................................... 4
3. Volume Accuracy .................................................................................................................................. 5
4. Operator Controls ............................................................................................................................... 5
5. Operating States ................................................................................................................................... 6
  5.1 Power-up ........................................................................................................................................ 6
  5.2 Ready State ..................................................................................................................................... 6
  5.2.1 Ready State – Untimed .................................................................................................................. 7
  5.2.2 Ready State – Interval Timed ......................................................................................................... 7
  5.2.3 Ready State – Daily Timed ........................................................................................................... 7
  5.2.4 Ready State – Weekly Timed ......................................................................................................... 7
  5.3 Dispensing ..................................................................................................................................... 8
  5.4 Top-Up Dispensing ........................................................................................................................... 9
  5.5 External Stops .................................................................................................................................. 9
  5.6 Leak Detection ................................................................................................................................. 10
6. Option Menus ...................................................................................................................................... 10
  6.1 Manual Mode ................................................................................................................................. 12
  6.2 Priming Mode .................................................................................................................................. 12
  6.3 Timed Mode Selection ...................................................................................................................... 13
  6.4 Interval Setting ............................................................................................................................... 13
  6.5 Setting Dispense Times – Daily Mode ............................................................................................... 14
  6.6 Setting Dispense Times – Weekly Mode ........................................................................................... 15
  6.7 Clock Adjustment ............................................................................................................................ 15
  6.8 Calibration Menu ............................................................................................................................ 16
  6.9 Compensation Menu ....................................................................................................................... 16
  6.10 External Input Menu ...................................................................................................................... 17
  6.11 Transistor Output Menu ................................................................................................................. 18
  6.12 Sound Menu .................................................................................................................................. 18
7. Remote Switch ..................................................................................................................................... 19
8. Transistor Output ................................................................................................................................. 19
9. External Inputs ..................................................................................................................................... 20
10. Serial Communications Control ...................................................................................................... 21
  10.1 PC Software Installation ................................................................................................................ 21
  10.2 USB Drivers ................................................................................................................................... 21
  10.3 Using the Software ......................................................................................................................... 22
  10.4 Diagnostic Display ........................................................................................................................... 25
11. Filter ..................................................................................................................................................... 26
12. Specifications ...................................................................................................................................... 27
Appendix A – Serial Port Settings and Commands .................................................................................. 28
1. Introduction

The DeeterFlow Automatic Liquid Dispenser incorporates a pump and a flow-meter to deliver a measured volume of liquid. Delivery can be initiated by the press of a button, by external input signal, or automatically by means of an internal timer. The timer can be selected to start dispensing at regular intervals or start dispensing at set times of the day, on a daily or weekly basis.

The volume is easy to select and is retained in non-volatile memory for repeat operation. Volumes between 0.20 litres and 100.00 litres can be selected in increments of 0.01 litres.

The dispenser includes a mesh filter at the inlet and an internal pump. The pump is self-priming and will maintain a constant rate of flow, typically around 3L/min for water (depending on external tubing, a clear filter, and the height the water is raised).

A simple calibration method enables the dispenser to repeatedly deliver accurately measured volumes. When dispensing water, there are options to allow automatic adjustments for variations in temperature and drifts in flow-rate.

The dispenser can be connected to a PC for remote control and monitoring with an easy-to-use software programme available at www.deeter.co.uk/downloads. An optional remote switch input is also provided for hands-free start/stop control.

Two additional inputs and a transistor output are also provided, together with a current-limited 5V power output. These inputs and outputs enable the dispenser to interact with a variety of external devices including active sensors, relays, LEDs and buzzers. Option menus provide a choice of interactions with inputs capable of starting a delivery, stopping a delivery or raising an alarm. The output can be linked to various dispenser functions and used to indicate progress to other equipment, signal an alarm or drive a valve or pump (via an external relay).
2. Installation

The dispenser has two John Guest Speedfit® push-fit connectors at the rear of the case for liquid 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).

Make sure the input and output tubes are pushed fully into the connectors before use. After initial resistance to insertion, the tube usually slips in by a few millimetres before hitting the stop position.

The 12VDC mains adapter supplied with the dispenser plugs into the socket labelled on the rear panel. Low voltage operation makes the dispenser safe to use in damp environments or where liquid can be spilt.

The dispenser is supplied with three circular connectors on the rear panel, whose uses are optional and varied:
- The 2-pin connector is for a remote switch, typically used for hands-free starting with a foot-switch. See section 7 for a detailed description.
- The 3-pin connector is for the transistor output. See section 8 for a description and connection details.
- The 6-pin connector is for two external inputs – see section 9.
A USB-B connector is provided on the front panel for automated control and monitoring by computer. A standard USB printer cable (not supplied) will link the dispenser to a PC. Installation and use of the PC software available for the dispenser is described in section 10.

3. Volume Accuracy

A calibration method allows fine adjustment of the delivered volume and can considerably reduce the size of any error. One or two 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 6.8) with adjustments down to 0.1%.

Accuracy in percentage terms will be better for larger volumes than for smaller volumes. Repeated accuracy should be within ±1% of the target 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 flow-rate range is 0.5L/min to 5.0L/min. Outside this range accuracy will be poor and the display will indicate whenever these limits are exceeded and sound an optional warning. (The internal pump should not be capable of reaching the upper limit.)

The dispenser has options to compensate for varying flow-rate and temperature when used for dispensing water – see the Compensation Menu section (6.9). The adjustments are a ‘best fit’ for a typical dispenser and will not provide the accuracy that can be achieved at constant temperature and flow-rate, but will reduce the errors caused by these two variables.

4. Operator Controls

The front-panel display shows the selected volume and progress during dispensing. It also enables various option menus to be viewed and provides warning messages if error conditions are detected.

Normal operator controls consist of three push-button switches with the following symbols printed above them:

<table>
<thead>
<tr>
<th>SYMBOL</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>UP</td>
</tr>
<tr>
<td></td>
<td>DOWN</td>
</tr>
<tr>
<td></td>
<td>ENTER</td>
</tr>
</tbody>
</table>
There is an optional external switch for remote start/stop control of the dispenser (see section 7), two optional inputs for automatic start and stop control (see section 9) and remote control is also possible via a PC (see section 10).

5. Operating States

5.1 Power-up

Power-up message

| A | L | D | V | 2 | . | 0 | 3 |

The display shows the firmware version for 5 seconds at power-up, then progresses to the Ready state.

5.2 Ready State

There are four operating modes: Untimed, Interval-timed, Daily-timed and Weekly-timed. The quiescent state, when not dispensing or accessing the option menus, is referred throughout as the ‘Ready State’ for all modes, although the word ‘Ready’ is only shown on the display in the untimed mode.

Changing the volume, using the top-up feature, and accessing Option menus are common to all four operating modes in their Ready state, using the front panel buttons as follows:

Press **UP** to increase the volume. Hold the button for rapid increases. The maximum setting is 100.00 litres.

Press **DOWN** to decrease the volume. Hold the button for rapid decreases. The minimum volume setting is 0.20 litres.

Hold the **UP** button and then **ENTER** to manually deliver a dose or a top-up at the end of a normal dispense (see *Top-up Dispensing*).

Hold the **ENTER** button for 3 seconds to access the Option Menus.

A change to the volume setting is saved to non-volatile memory after 30 seconds, or at the start of the next dispense.
5.2.1 Ready State – Untimed

![Ready State - Untimed](image)

In the Untimed mode, a single press of the ENTER button will start dispensing. The remote switch can also be used to start.

5.2.2 Ready State – Interval Timed

![Ready State - Interval Timed](image)

In Interval-timed mode, dispenses are started automatically at regular intervals. An interval of between 1 minute and 24 hours can be set, in one-minute divisions.

The top line of the display shows the interval setting in hours and minutes. The bottom line shows the volume and the countdown time in hours and minutes. The colon of the countdown time blinks every second to indicate the passage of time. The bottom line changes to show remaining seconds for the final 60 seconds of the countdown.

5.2.3 Ready State – Daily Timed

![Ready State - Daily Timed](image)

In Daily-timed mode, dispenses are started automatically at set times of the day. Up to eight start times can be set.

The top line shows the time-of-day with the colon blinking to indicate the passage of time. The bottom line indicates the next start time. If the start time is shown as **:**,**, no times have been set.

5.2.4 Ready State – Weekly Timed

![Ready State - Weekly Timed](image)

In Weekly-timed mode, dispenses are started automatically at set times of the day on a 7-day basis. Up to eight start times per day can be set, including the option of having no times on some days.

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5.3 Dispensing

In all operating modes the display will show the flow rate, the delivered volume and the target volume when dispensing.

```
3 . 1 2 L / m i n
4 . 5 6 / 1 0 . 0 0
```

Pressing ENTER will stop delivery with ‘PAUSED’ shown on the display. Pressing ENTER again will resume delivery.

```
P A U S E D
4 . 6 0 / 1 0 . 0 0
```

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

Dispense accuracy will be compromised if the flow-rate exceeds the limits of 0.5L/min to 5.0L/min. Below 0.5 litres per minute, the word ‘UNDER’ will flash, alternating with the flow-rate, and a short beep will sound every 5 seconds if the Warning Beep option is enabled. At very low flow-rates the word ‘UNDER’ will remain constant, and if there is no detected flow for 20 seconds, the dispenser will automatically go to the Paused state.

It should not be possible to exceed 5 litres per minute with the pump provided. However, if this should happen, the word ‘OVER’ will flash, alternating with the flow rate.

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

The pump will automatically switch off in the Ready state during normal use. However, if air is allowed to enter the system and is trapped with the valve closed, the pump will remain on and the system will require priming. Starting a dispense will open the valve to allow priming (in timed modes this can be done using the top-up feature), but if there is no user intervention for 15 seconds the pump will switch off and the dispenser will enter Priming Mode – see the Priming Mode section for more details.
5.4 Top-Up Dispensing

Press and hold the UP button and then press ENTER 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 10.00 litres.

(The press of the UP button will temporarily change the volume setting, but the previous setting will be restored immediately top-up dispensing has started.)

Whenever ENTER 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 with a plus sign.

| 3 . 1 2 L / m i n | + 1 0 . 2 4 L i t r e s |

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

| 1 0 . 0 0 L i t r e s | + 1 0 . 2 4 L i t r e s |

The dispenser will remain in Top-Up state while UP or ENTER are pressed and for 4 seconds after both buttons are released.

See also Manual Mode, accessed via the Option Menus

5.5 External Stops

The two optional external inputs can be selected to stop dispensing. These inputs can be used as emergency stops in case of an overflow level being reached or a leak being detected. They may also be used to deliver a volume determined by float-switches rather than by the dispenser's volume setting.

| R E A D Y | 1 0 . 0 0 L S T O P |

If a stop input becomes active in any of the Ready states, the word 'STOP' appears on the bottom line followed by the identity number of the active input. In this state, dispensing cannot be started.
If a stop input becomes active while dispensing, the word ‘STOPPED’ appears on the top line together with the identity number of the input. The bottom line continues to show the delivered volume and target volume.

When a stop input changes to inactive, there are two actions the dispenser can perform: either continue dispensing or return to the Ready state. These actions are selected in the menus (see section 6.10), labelled as ‘STOP/GO’ and ‘STOP/END’ respectively.

5.6 Leak Detection

The dispenser has a sensor to detect any leakage of conductive liquids (e.g. water) inside the enclosure. In the unlikely event of a leak, the pump and valve will be switched off and the dispenser will be disabled with the following message:

```
LEAK DETECTED
DISPENSER OFF
```

Please contact your supplier for assistance if this display is seen.

6. Option Menus

Option Menus are accessed from the Ready state (untimed and timed modes) by pressing and holding ENTER for 3 seconds.

The top level of menu are indicated by the enter symbol ➫. Pressing UP or DOWN will cycle through the option menus and ENTER will select a submenu (except from the EXIT menu where ENTER will return to the Ready state).
If Interval Mode is selected

SELECT
TIME MODE

SET INTERVAL

If Daily or Weekly-timed Modes are selected

SET DISPENSE TIMES

If a Timed mode is selected

ADJUST CLOCK

CHANGE CALIBRATION

COMPENSATION OPTIONS

EXTERNAL INPUT OPTIONS

OUTPUT OPTIONS

SOUND OPTIONS

EXIT
6.1 Manual Mode

Manual Mode is similar to Top-Up Dispensing but does not require a button to be held in order to remain in the mode and there is no target volume shown.

In the equivalent of the Ready state, the word MANUAL is shown instead, with the dispensed volume on the bottom line.

<table>
<thead>
<tr>
<th>MANUAL</th>
<th>0.000 liters</th>
</tr>
</thead>
</table>

Press UP to dispense and the display will change to show the flow-rate and dispensed volume

<table>
<thead>
<tr>
<th>3.12 L/min</th>
<th>0.24 liters</th>
</tr>
</thead>
</table>

Release the UP button to pause dispensing

<table>
<thead>
<tr>
<th>MANUAL</th>
<th>1.24 liters</th>
</tr>
</thead>
</table>

To clear the measured volume, press the DOWN button

<table>
<thead>
<tr>
<th>MANUAL</th>
<th>0.000 liters</th>
</tr>
</thead>
</table>

Pressing ENTER returns to the Option Menu

6.2 Priming Mode

Priming Mode can be started via the Option Menus or started automatically if the pump remains on for 15 seconds when it should have switched off – from the Ready or Paused states.

At the start of Priming Mode, the pump is switched off and the valve is closed

<table>
<thead>
<tr>
<th>PRIMING - PUMP OFF</th>
</tr>
</thead>
<tbody>
<tr>
<td>VALVE CLOSED</td>
</tr>
</tbody>
</table>
Pressing **UP** toggles the pump on and off. Pressing **DOWN** toggles the valve open and closed.

**ENTER** will return to the Option Menu and close the valve if it was left open. If this mode was started automatically from the Ready or Paused states, **ENTER** will still access the Option menus and enable the operator to return to Ready state.

The system can be primed by switching on the pump and opening the valve until air has been flushed out. Closing the valve should then cause the pump to stop automatically and priming has been successful.

If the dispenser entered this mode from normal operations, the dispenser will automatically return to the Ready state when priming has been successful.

If Priming Mode was entered from the option menus, priming may be continued and the display will show:

```
P R I M E D  -  P U M P  O N
V A L V E  C L O S E D
```

### 6.3 Timed Mode Selection

Press **UP** or **DOWN** to cycle through the four options:
- TIMING DISABLED
- INTERVAL TIMING
- DAILY TIMING
- WEEKLY TIMING.

Press **ENTER** to select the mode.

### 6.4 Interval Setting

This menu is only seen if Interval-timed mode has been selected

```
C H A N G E  I N T E R V A L
0 0 : 3 0
```

Times are shown in hours and minutes. The default time is 30 minutes, the minimum is 1 minute and the maximum is 24 hours.
A cursor will appear below the hours setting and the **UP** and **DOWN** buttons can be used to select the hours.

Pressing **ENTER** advances to the minutes, indicated by the cursor under the minutes setting, and **UP** and **DOWN** can be used to select the minutes.

Note that the interval is the period between start times. If an interval is chosen that is shorter than the time it takes to deliver the target volume, start times will be missed. For example, if 10 litres takes just over 3 minutes to dispense, an interval setting of 3 minutes will effectively become an interval of 6 minutes.

The next press of **ENTER** saves the interval time and returns to the option menu.

**6.5 Setting Dispense Times – Daily Mode**

This menu is only seen if Daily-timed mode has been selected

<table>
<thead>
<tr>
<th>2 4 h</th>
<th>M O D E T I M E 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 9 : 0 0</td>
<td></td>
</tr>
</tbody>
</table>

To view previously set times without changing them, press only the **ENTER** button.

If no times have previously been set, the display will show **:**

The cursor starts under the hours setting, **UP** and **DOWN** increment and decrement the hour. **ENTER** advances to minutes, indicated by the cursor position. When the minutes are correct, press **ENTER** again.

<table>
<thead>
<tr>
<th>2 4 h</th>
<th>M O D E T I M E 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 9 : 0 0</td>
<td></td>
</tr>
</tbody>
</table>

The next time shown will be:

**:** if no time was previously set

The previously saved time if **UP** or **DOWN** have not been pressed

The same time as that just selected for the previous daily time

Pressing **ENTER** when **:** is shown will exit back to the option menu.

To set fewer than the maximum of 8 times, either press **UP** in the hour selection state until **:** is shown (after 24 hours), or leave the hours and minutes the same as for the previous time for that day.
If a new time is selected, ENTER will advance to the next time setting. After the eighth time is viewed or set, ENTER will return to the option menu.

6.6 Setting Dispense Times – Weekly Mode

This menu is only seen if Weekly-timed mode has been set.

<table>
<thead>
<tr>
<th>MONDAY</th>
<th>TIME</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td>09</td>
<td>00</td>
<td></td>
</tr>
</tbody>
</table>

Up to 8 times can be set per day, in a similar manner to that described for setting Daily times.

Previously set times can be viewed without changing them by only using the ENTER key.

After setting Monday’s times, the day will change to Tuesday, then Wednesday etc. After the last time on Sunday, ENTER will return to the option menu.

6.7 Clock Adjustment

This menu is only seen if a timing mode has been selected.

<table>
<thead>
<tr>
<th>CHANGE</th>
<th>WEEKDAY</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>WEDNESDAY</td>
<td>12 : 34</td>
<td></td>
</tr>
</tbody>
</table>

UP and DOWN change the day of the week. ENTER advances to hours.

<table>
<thead>
<tr>
<th>CHANGE</th>
<th>HOURS</th>
</tr>
</thead>
<tbody>
<tr>
<td>MONDAY</td>
<td>12 : 34</td>
</tr>
</tbody>
</table>

UP and DOWN changes the hour in 24-hour format. ENTER advances to minutes.

<table>
<thead>
<tr>
<th>CHANGE</th>
<th>MINUTES</th>
</tr>
</thead>
<tbody>
<tr>
<td>MONDAY</td>
<td>09 : 34</td>
</tr>
</tbody>
</table>

UP and DOWN change the minutes. ENTER returns to the option menu.

The day and time can be viewed without changing it by using just the ENTER button in the three clock-adjustment menus. If the day or time is changed, ENTER will write the new time to the real-time clock IC with the seconds zeroed.
6.8 Calibration Menu

The Calibration Menu enables fine adjustment of the dispense volume. The calibration limits are -12.0% to +12.0% with negative numbers reducing and positive numbers increasing the volume delivered.

<table>
<thead>
<tr>
<th>CALIBRATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>+4.7%</td>
</tr>
</tbody>
</table>

UP and DOWN increment/decrement the percentage. Holding the button will rapidly change the percentage. Pressing ENTER saves the calibration value to non-volatile memory and returns to the option menu.

6.9 Compensation Menu

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

<table>
<thead>
<tr>
<th>FLOW ADJUST</th>
<th>OFF</th>
</tr>
</thead>
<tbody>
<tr>
<td>TEMP ADJUST</td>
<td>ON</td>
</tr>
</tbody>
</table>

Pressing UP will toggle the FLOW ADJUST option between ON and OFF. When ON is selected, the dispenser will add to the percentage adjustment a small amount which varies with the flow-rate. This will compensate for the typical effects of flow-rate change on dispense accuracy for water.

Pressing DOWN will toggle TEMP ADJUST between ON and OFF. When ON is selected, the dispenser will add to the percentage adjustment a small amount which varies with temperature. This will compensate for the typical effects of water temperature on dispense accuracy.

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.

Pressing ENTER saves the compensation options to non-volatile memory. If TEMP ADJUST is set to ON, the Temperature Offset screen will appear:

<table>
<thead>
<tr>
<th>TEMP</th>
<th>+20.5°C</th>
</tr>
</thead>
<tbody>
<tr>
<td>ZERO</td>
<td>-21.0°C</td>
</tr>
</tbody>
</table>
The top line displays the liquid temperature and the bottom line shows the zero offset. Default zero offset is -21°C and any calibration change is unlikely to vary by more than a few degrees. Press **UP** to increase the offset (make it less negative) and **DOWN** to decrease the offset. **ENTER** returns to the option menu.

### 6.10 External Input Menu

<table>
<thead>
<tr>
<th>INPUT 1</th>
<th>ACTIVE - L</th>
</tr>
</thead>
<tbody>
<tr>
<td>INPUT 2</td>
<td>ACTIVE - H</td>
</tr>
</tbody>
</table>

The first submenu enables the active state of the two inputs to be selected. The input from a switch connected to the dispenser is low when closed and high when open or disconnected.

**UP** toggles the INPUT 1 setting and **DOWN** toggles INPUT 2. **ENTER** advances to the Input Function menu.

<table>
<thead>
<tr>
<th>INPUT 1</th>
<th>ALARM</th>
</tr>
</thead>
<tbody>
<tr>
<td>INPUT 2</td>
<td>STOP/GO</td>
</tr>
</tbody>
</table>

**UP** cycles through INPUT 1 function settings and **DOWN** cycles through INPUT 2 settings. **ENTER** saves settings and returns to the option menu.

The two inputs can be independently assigned the following functions:

- **DISABLED** – input not used
- **ALARM**
- **STOP/GO**
- **STOP/END**
- **START**

**ALARM** enables the input to determine the state of the transistor output. This requires the output to also be assigned to **ALARM**.

**STOP/GO** enables the input to halt dispensing. If dispensing had started it will pause and when the input returns to the inactive state, dispensing resumes.

**STOP/END** enables the input to halt dispensing. If dispensing had started it will pause and when the input returns to the inactive state, the dispenser will return to the Ready state.

**START** allows the input to start dispensing in untimed mode only. This function is different to the Remote Switch input in that it will not pause or cancel delivery once dispensing has started.

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6.11 Transistor Output Menu

<table>
<thead>
<tr>
<th>OUTPUT DISPENSE</th>
</tr>
</thead>
</table>

**UP** and **DOWN** cycle through the output options. **ENTER** saves settings and returns to the option menu.

Transistor output options are:
- **DISABLED** – output not used
- **DISPENSE** – output is active whenever the dispenser operates
- **FINISH** – active for 2 seconds at the end of a dispense
- **WARNING** – active whenever an error condition occurs that would cause a warning beep (see Sound Menu)
- **ALARM** – active if an external input is assigned to Alarm and is active
- **STOP** – active if an external input is assigned to STOP (STOP/GO or STOP/END) and is active

6.12 Sound Menu

There are two audio options: FINISH BEEP and WARNING BEEP

<table>
<thead>
<tr>
<th>FINISH BEEP</th>
<th>OFF</th>
</tr>
</thead>
<tbody>
<tr>
<td>WARNING BEEP</td>
<td>ON</td>
</tr>
</tbody>
</table>

Pressing **UP** toggles the FINISH BEEP option between ON and OFF. When ON is selected, a long beep will sound at the end of dispensing.

Pressing **DOWN** will toggle WARNING BEEP between ON and OFF. When ON is selected, short beeps will be heard to warn of error conditions. These include:
- Flow-rate outside accurate dispensing limits (below 0.5L/min or above 5.0L/min)
- Priming error
- Leak detected

Pressing **ENTER** saves the sound options to non-volatile memory and returns to the Option Menu.
7. Remote Switch

A circular 2-pin socket is available on the rear of the dispenser and may be used as a remote switch input. The dispenser comes with a 2-pin mating plug and it is left for the user to wire to this plug the preferred type of switch. The two wires from a passive switch can be connected either way to these pins.

The input duplicates the function of the ENTER button when the dispenser is in the Untimed Ready, Dispensing and Paused states. It can therefore start dispensing in untimed mode, or pause, restart and cancel dispensing in all modes. It cannot be used to access or navigate the option menus.

This input is typically connected to a foot-switch to allow hands-free starting of the dispenser.

8. Transistor Output

A circular 3-pin socket is available on the rear of the dispenser for the transistor output. The dispenser comes with a 3-pin mating plug, connection details shown below:

![Diagram of 3-pin socket]

The output is from an open-collector transistor which must be pulled high externally and connects to the 0V rail when active. The output can be pulled high to a maximum of 40V and can sink up to 50mA, with the current limited to protect the transistor from a short-circuit. If used to switch an inductive load, measures must be taken to protect the transistor from high-voltage transients.

The 5V pin is current-limited and can supply up to 50mA. This pin may be used to drive an external circuit controlled by the transistor output, for example, to power an external buzzer alarm.
The transistor output is typically used to drive an external relay to control a pump or valve in conjunction with an activity of the dispenser – see the Transistor Output Menu section (6.11) above.

9. External Inputs

A circular 6-pin socket is available on the rear of the dispenser to provide input from two external sources. The dispenser comes with a 6-pin mating plug, connection details shown below:

![Diagram of 6-pin socket]

The two input circuits are identical. Normal passive switches connect between the IN and 0V pins. The 5V pins can supply up to 50mA (combined) to power active switching devices such as optical level sensors, Hall-effect switches or the Deeter Leak Sensors.

The inputs are assigned functions via the External Input Menu (see 6.10). They are typically connected to float switches for detecting emergency-stop levels, but may be used in conjunction with the output to provide a wide range of installation-specific requirements. For example:

With a float-switch set to the START function fitted at the bottom of a vessel and another float-switch set to the STOP/END function fitted at the top of the vessel, dispensing can be started and stopped automatically, according to levels in the vessel.

Note that in this arrangement the dispenser does not determine the volume delivered, but while the top float-switch remains active, will display the volume it measured.

If, in the above arrangement, the transistor output is assigned to the DISPENSE function and switches on a valve or pump (via a relay), this could empty the vessel when it is full, making the filling and emptying cycle fully automatic.
10. 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 PC-to-printer cable with a USB type-B connector at the dispenser end (not supplied).

The PC software available for the dispenser replicates the operator controls and makes it easy 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.

Note: the software was originally developed for the Deeter Liquid Volume Dispenser and is currently limited to the range of functions of the Deeter Automatic Liquid Dispenser in untimed mode and without the optional external input and output features. Future developments will enhance the PC software to include all features. References to the Liquid Volume Dispenser in this section also apply to the Automatic Liquid Dispenser.

10.1 PC Software Installation

The PC software can be downloaded from www.deeter.co.uk/downloads. Once downloaded, extract all files from the zipped file to a suitable directory, e.g. c:\Deeterflow, and click on the setup.exe file.

The 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

10.2 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.
10.3 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 dispenser 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 checkboxes enable and disable the Finish Beep and Warning Beep.
**Finish Beep** - A simple beep upon completion of the dispensing of liquid.

**Warning Beep** - This beep is heard if the flow rate goes above or below the limits for accurate dispensing.

These two checkboxes enable and disable the automatic adjustments for flow-rate and temperature. By default these options are enabled.

**Temp. Adjustment** – the dispenser will add a percentage to the dispense volume in accordance with the measured temperature thus compensating for the typical effects of water temperature on dispense accuracy, between 0C and 43C.

**Flow Rate Adjustment** – compensation for changes in flow rate.

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 \(\uparrow\) to increase the volume. The maximum setting is 100.00 litres.

Press \(\downarrow\) to decrease the volume. The minimum volume setting is 0.20 litres.

The Target Volume can be entered directly into the box or by clicking on UP or DOWN. Please note the maximum and minimum volumes are 100.00 and 00.20

Click \(\text{START} \rightarrow\) to start dispensing.

10.4 Diagnostic Display

This display shows the commands flowing between the 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.
11. Filter

A stainless steel filter is accessible from the rear of the dispenser. The 60-mesh (25 micron) filter is positioned immediately after the inlet to prevent particles reaching any of the internal apparatus.

The first sign of a blocked filter is reduced flow-rate, so the filter should be checked whenever the flow-rate becomes unusually low.

Unscrewing the filter cap will allow liquid to escape and measures should be taken to capture or soak-up any spillage. Once unscrewed, the stainless steel mesh can be pulled away from the filter body, rinsed to clear any blockages and returned.

The dispenser will have air in the inlet tube after the filter has been cleaned and some liquid will need to be pumped through the dispenser to flush this air out.
12. Specifications

**Dimensions**
265mm wide, 120mm high, 295mm deep
(excluding plumbing and wiring connections)

**Weight**
3.5kg

**Power supply requirements**
10-15V @3A (12VDC mains adapter supplied)

**Fuse**
4A, anti-surge, 5x20mm cartridge

**Sound level**
65 decibels (typical, while pump is operating)

**Plumbing connections**
John Guest Speedfit® for 8mm OD tube

**Serial communications connector**
USB type B socket

**Remote switch connector**
Locking 2-pin DIN plug (Mating socket supplied)

**Transistor output connector**
Locking 3-pin DIN plug (Mating socket supplied)

**External input connector**
Locking 6-pin DIN plug (Mating socket supplied)

**Transistor output**
NPN open-collector. Maximum collector voltage = 40V
Maximum current = 50mA

**5V supply to transistor output & external input connectors**
Maximum current = 50mA (total combined output)

**Dispensed volume range**
0.20 – 100 litres in 0.01 litre steps

**Typical flow-rate**
3 litres per minute

**Flow-rate range**
0.5 – 5.0 litres per minute

**Dispense accuracy**
±1%

**Liquid temperature range**
0°C to +43°C

**Filter**
Stainless steel, 60 Mesh (250 microns)

**Wetted materials**
- Acetal (polyformaldehyde)
- Santoprene (EPDM/polypropylene composite)
- Polyether polyurethane
- Glass-filled polypropylene
- Glass-filled polyamide (Nylon)
- Polyamide-12 (Nylon-12)
- Nitrile rubber (NBR)
- EPDM rubber
- Stainless steel
- PTFE/graphite

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(1) Suitable tube materials include: polyethylene, nylon, polyurethane, brass, copper, mild steel. For soft or thin-walled tubing, tube inserts should be used.

(2) Water, 12V supply, clear filter, minimal external tube restrictions and minimal pumping height.

(3) For accurate dispenses

(4) Water at constant temperature and flow rate
Appendix A – Serial Port Settings and Commands

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 in the range 'A' to 'Z' and 'a' to 'z'
- P1 to Pn are parameters in the range '0' to '9', or the characters '+', '-' (minus), ',' (comma) and '?' (question-mark)
- **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'.

Example: the string Sp00553A will set the interval period to 00:55. The checksum is the hexadecimal sum

$$70h \ (ASCII \ p) + 30h \ (ASCII \ 0) + 30h + 35h \ (ASCII \ 5) + 35h = 13Ah$$

The least significant 8-bits are 3Ah and these are sent as two ASCII characters 33h (ASCII 3) and 41h (ASCII A).

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, and 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 parameter 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:

$$A<xxxx>,<yyyy>,<zzz>,<m><CR>$$

where <xxxx> is the dispensed volume in centilitres (5 bytes), <yyyy> 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 comma.

The temperature is in units of 0.5C with a default zero at -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 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 Dispense volume
This will return the present dispensed volume in the form:

D<xxxxx><CR>

where <xxxxx> is the dispensed volume in centilitres.

E set End beep – off/on (0/1/?)
A '?' after the command character will return the current status of the End Beep.

F report Flow 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 5 litres per minute so the first two digits should always be ‘0’.

G Go
This command will start a dispense

H Halt
This command will terminate a dispense

I set Temperature Adjustment – off/on (0/1/?)
A '?' after the command character 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.

K set thermistor zero-offset temperature (00-99/?)
The default zero offset for the thermistor is -21C. Any variation from this will have little or no effect on temperature compensation, but absolute temperatures can be displayed by the PC software and this command allows for calibration of the displayed temperature.

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

M report Mode
This will return:
M<n><CR>
where <n> is a number from 1 to 4 to indicate the current status of the dispenser:

1  Ready
2  Dispensing
3  Paused
4  The dispenser is under operator control from the keypad (e.g. manual dispensing, option setting, etc.) or in a timed mode.
5  Leak detected

N  report version N umber
This will return the firmware version number e.g. ‘ALD V1.01’

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

R  Restart
This command will restart a paused dispense

T  report Target volume
This command will return the target volume in the form:
T<xxxxx><CR>
where <xxxxx> is the volume in centilitres.

V  set Volume (00010-10000/?)
Sets the target volume in centilitres.
A '?' after the command character will report the target volume (same as the T command)

W  set Warning beep – off/on (0/1/?)
A '?' after the command character 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 will report the calibration (same as the Y command)

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.

c  set real-time-c  clock – weekday (1-7) hour (00-23) minute (00-59)
Sets the RTC, with weekday 1=Monday, 2=Tuesday, etc. Seconds are cleared.
A '?' after the command character will report the RTC time in the form:
c<dhhmms><CR>
where d is the current weekday, hh is the hour, mm are the minutes and ss are the seconds.
### Deeter Automatic Liquid Dispenser – User Manual

- **d** set dispense times – weekday (0-7) hour1 (00-23) minute1 (00-59) comma (,) hour2 (00-23) minute2 (00-59) comma (,) … comma (,) hour8 (00-23) minute8 (00-59)
  Sets up to eight dispense times for a weekday, where weekday 0 sets the dispense times for daily-timed mode and 1=Monday, 2=Tuesday, etc. for weekly-timed mode. Fewer than eight times can be set by terminating the command string with the checksum where a comma-separator would go.
  A '?' after the weekday character will report the dispense times for that day in the form:
  c<hhmm>,<hhmm>,...,<hhmm><CR>
  where hh is the hour, mm are the minutes and times are separated by a comma. Up to 8 sets of times will be reported, but fewer times will be sent if fewer times have been set.

- **i** set input assignment – input (1/2) polarity (0/1) function (0-4)
  Assigns a function and the active-state (polarity) to one of the two external inputs, where polarity 0 is active-low and 1 is active-high, and functions are:
  0 disabled
  1 alarm
  2 stop/go
  3 stop/end
  4 start
  A '?' after the command character will report the polarity and assignment for both inputs in the form:
  c<pf>,<pf><CR>
  where p is the polarity, f is the function and a comma separates the input 1 and input 2 reports.

- **o** set output assignment – function (0-5)
  Assigns a function to the transistor output – see the Transistor Output Menu section for details of functions. Function assignments are:
  0 disabled
  1 dispense
  2 finish
  3 warning
  4 alarm
  5 stop
  A '?' after the command character will report the present function assignment.

- **p** set interval period – hours (00-24) minutes (00-59)
  Sets the interval for interval-timed mode. The minimum interval is one minute and the maximum is 24 hours zero minutes.
  A '?' after the command character will report the interval in the form:
  c<hhmm><CR>
  where hh are hours and mm are minutes.

- **t** set timed mode – (0-3)
  Sets the timed options, where modes are:
  0 untimed
  1 interval timed
  2 daily timed
  3 weekly timed
  A '?' after the command character will report the present mode.