Loctite® EQ VA30 Jet Valve 1850212 &
Loctite® EQ VA30 Jet Valve Controller 1850211
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1. Safety Guidelines

The described fluid applicator and controller are resources for use in industrial environments.

The Loctite® EQ VA30 products are manufactured according to currently valid engineering standards and are operationally safe. Hazards may arise if handled improperly by unqualified personnel. Thorough review of operating instructions is recommended for the operating personnel.

**CAUTION!**
The connecting cables may only be removed or attached when the controller is not delivering voltage to the valve. To insure this, turn off the main power switch on the front of the controller.

**CAUTION!**
Be sure to use only the main input power cord supplied with the unit. The power cord supplied with the unit supports 100/120V in the USA. If you are planning to use the unit in countries using 220/240V, please replace the main power cord with an approved TUV power cord rated for 220/240V.

**CAUTION!**
Qualified personnel are persons who, due to their training, expertise and instruction, as well as their knowledge of relevant standards, provisions, accident prevention regulations and operating conditions, have been authorized by the person responsible for safety of the system to perform the required tasks and, in the process, can identify and prevent potential risks (definitions for specialists according to the VDE 105 or ICE 364)

**CAUTION!**
Shock Hazard. There are no user-serviceable components under the covers. Mains voltages ranging from 100 to 240 VAC are inside. Disconnect the power cord and contact Henkel if there is any desire to remove the covers.

**CAUTION!**
Observe general safety regulations for the handling of chemicals such as Loctite® adhesives and sealants. Observe the manufacturer’s instructions as stated in the Material Safety Data Sheet (MSDS).

**Notice:** While under warranty, the unit may be repaired only by an authorized Henkel service representative.

1.1 Unpacking and Inspection

Carefully unpack the Loctite® EQ VA30 Jet Valve & Controller and examine the items contained in the cartons. Inspect the units for any damage that might have occurred in transit. If such damage has occurred, notify the carrier immediately. Claims for damage must be made by the consignee to the carrier and should be reported to the manufacturer.

1.2 Items supplied (Separate Boxes)

<table>
<thead>
<tr>
<th>1850211 EQ VA30 Jet Valve Controller</th>
<th>1850212 EQ VA30 Jet Valve</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jet Valve Controller</td>
<td>Jet Valve</td>
</tr>
<tr>
<td>Controller to Robot Cable</td>
<td>Air Connection Tubing 6mm x 1.5 meters</td>
</tr>
<tr>
<td>AC Power Cord</td>
<td>3mm Hex Driver</td>
</tr>
<tr>
<td>D-Sub 15 Pin HD Male To Female Cable</td>
<td>Diaphragm FFKM, Black (5 Pack)</td>
</tr>
<tr>
<td>Air Connection Tubing 6mm x 2 meters</td>
<td>Diaphragm O-Ring (5 Pack)</td>
</tr>
<tr>
<td>Equipment Manual</td>
<td>Adapter Ring For 10cc Syringes</td>
</tr>
<tr>
<td></td>
<td>Syringe Air Line Adapter</td>
</tr>
</tbody>
</table>
2. Introduction and Specifications

2.1. Overview

The EQ VA30 Jet Dispensing System is a non-contact jetting technology and is a major leap in liquid dispensing. The non-contact jetting is fast, allowing dispensing rates up to 300Hz. The user can adjust the drop size ± 20% from the nominal size allowing a wide range of adjustability. The simplicity of dispense system is also evident in its ease-of-cleaning since all parts that touch the fluid are easily removed.

The EQ VA30 Jet Valve Controller provides pneumatic resources, electrical resources, and timing signals for the EQ VA30 Jet Valve.

The EQ VA30 Jet Valve Controller
- provides an internal computer that remembers and executes a variety of operational sequences;
- responds to actuation signals from either a front panel switch or from an external switch.
- provides timing signals to drive a rapid-response solenoid valve in the EQ VA30 Jet Valve;
- provides regulated, pressurized air output for the fluid pressure input of the EQ VA30 Jet Valve;
- provides regulated, pressurized air output for the Jet pressure input of the EQ VA30 Jet Valve;
- provides electrical power to a heater element in the EQ VA30 Jet Valve;
- controls the temperature of the Jet heater by monitoring an RTD temperature sensor in the EQ VA30 Jet Valve.

2.2. EQ VA30 Jet Valve Specifications

<table>
<thead>
<tr>
<th>PARAMETER</th>
<th>SPECIFICATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Size:</td>
<td>Width: 25.4 mm</td>
</tr>
<tr>
<td>EQ VA30 Jet Valve</td>
<td>Height: 90.3 mm</td>
</tr>
<tr>
<td>(without mounting bracket)</td>
<td>Depth: 82.0 mm</td>
</tr>
<tr>
<td></td>
<td>Weight: 400 grams</td>
</tr>
<tr>
<td>Drop Size Range:</td>
<td>Typical, depends on material</td>
</tr>
<tr>
<td>75 µm Nozzle</td>
<td>• 5-25 µgrams</td>
</tr>
<tr>
<td>125 µm Nozzle</td>
<td>• 25-80 µgrams</td>
</tr>
<tr>
<td>200 µm Nozzle</td>
<td>• 80-200 µgrams</td>
</tr>
<tr>
<td>Speed:</td>
<td>• Refill time:</td>
</tr>
<tr>
<td></td>
<td>• Dwell time:</td>
</tr>
<tr>
<td></td>
<td>• &gt;1.7 msec</td>
</tr>
<tr>
<td>Fluid Viscosity range:</td>
<td></td>
</tr>
<tr>
<td>Fluid Syringes:</td>
<td>1-400K mPas (cps)</td>
</tr>
<tr>
<td>Input Air pressure</td>
<td>Jet: 0.24 Mpa (35 psi) - Min</td>
</tr>
<tr>
<td></td>
<td>Fluid: 0.62 Mpa (90 psi) - Max</td>
</tr>
<tr>
<td></td>
<td>Fluid: 0.27 Mpa (40 psi) - Max</td>
</tr>
<tr>
<td>Nozzle Heater:</td>
<td>• Heating, Room temperature to 70°C Max</td>
</tr>
<tr>
<td></td>
<td>• + or - 1.0°C @ 50°C</td>
</tr>
<tr>
<td></td>
<td>• PID control using platinum RTD</td>
</tr>
<tr>
<td></td>
<td>• 24VDC, 5.7W, 100 ohm</td>
</tr>
<tr>
<td>Ambient Temperature:</td>
<td>15°C to 50°C</td>
</tr>
</tbody>
</table>
2.3. EQ VA30 Jet Valve Controller Specifications

<table>
<thead>
<tr>
<th>PARAMETER</th>
<th>SPECIFICATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Size:</td>
<td>Width: 254.0 mm</td>
</tr>
<tr>
<td></td>
<td>Height: 152.5 mm</td>
</tr>
<tr>
<td></td>
<td>Depth: 341.4 mm</td>
</tr>
<tr>
<td></td>
<td>Weight: 3200 grams</td>
</tr>
<tr>
<td>Power:</td>
<td>100-240 Vac, 50/60Hz, 50 Watts maximum, single phase</td>
</tr>
<tr>
<td></td>
<td>Fuse: 5 x 20 mm, Quick-Acting, 1 amp, 250 VAC</td>
</tr>
<tr>
<td>Input Air Pressure:</td>
<td>• Source: 0.48 to 0.69 Mpa Max</td>
</tr>
<tr>
<td></td>
<td>• Clean, dry air required</td>
</tr>
<tr>
<td></td>
<td>• 40µm filter required</td>
</tr>
<tr>
<td></td>
<td>• External pressure release device recommended 0.7 Mpa (100 psi)</td>
</tr>
<tr>
<td>Output Air pressure</td>
<td>Jet: 0.24 Mpa (35 psi) - Min</td>
</tr>
<tr>
<td></td>
<td>0.62 Mpa (90 psi) - Max</td>
</tr>
<tr>
<td></td>
<td>Fluid: 0.27 Mpa (40 psi) - Max</td>
</tr>
<tr>
<td>Nozzle Heater:</td>
<td>• Heating, Room temperature to 70°C Max</td>
</tr>
<tr>
<td></td>
<td>• ± 1.0°C @ 50°C</td>
</tr>
<tr>
<td></td>
<td>• PID control using platinum RTD</td>
</tr>
<tr>
<td></td>
<td>• 24VDC, 5.7W, 100 ohm</td>
</tr>
<tr>
<td>Ambient Temperature:</td>
<td>15°C to 50°C</td>
</tr>
<tr>
<td>Controller Interface:</td>
<td>• LCD Display with keypad</td>
</tr>
<tr>
<td></td>
<td>• RS-232 Serial Port</td>
</tr>
<tr>
<td>Input/Output:</td>
<td>26 pin DB connector, digital inputs pulled to GND</td>
</tr>
<tr>
<td>EQ VA30 Jet Valve Controller Software:</td>
<td>Windows XP, Vista and Windows 7 or 8</td>
</tr>
<tr>
<td></td>
<td>Fluid tables with parameters</td>
</tr>
<tr>
<td></td>
<td>Programmable drop recipes</td>
</tr>
<tr>
<td>Ingress Protection</td>
<td>IP20 / TYPE 1</td>
</tr>
<tr>
<td></td>
<td>Protected against ingress of solid foreign objects</td>
</tr>
<tr>
<td></td>
<td>greater than 12.5 mm. Not protected for ingress of water. Enclosure constructed for indoor use.</td>
</tr>
<tr>
<td>Altitude</td>
<td>2000 meters maximum (6652 ft)</td>
</tr>
</tbody>
</table>

2.4. Technical Assistance

- Henkel AG & Co. KGaA
  Site Munich
  Gutenbergstr. 3
  85748 Garching
  Germany
  +49 89 320 1800

- Henkel Corporation
  One Henkel Way
  Rocky Hill, CT 06067
  1-800-562-8483

- Henkel Display Center
  Building 1, No. 306
  Libing Rd., Pudong
  Shanghai, P.R. China 201203
  +86 21 2891 8000

- Henkel Display Center
  www.equipment.loctite.com
2.5. Dimensions – EQ VA 30 Jet Valve Controller
2.6. Dimensions EQ VA 30 Jet Valve

Shown below are the mechanical dimensions of the EQ VA 30 Jet Valve. The valve can be mounted to a variety of robots when X-Y-Z motion is desired. It can also be mounted stationary over a transporting mechanism like a conveyor belt or shuttle table. The valve mount bracket provides two sets of mounting holes located on the rear mounting plate for rigid attachment to a robot’s X-Y-Z stage. Additionally, the rear mounting plate allows the valve to be mounted in a channel which allows adjustment of the dispense tip to the dispensing surface. The dispense tip relative to the mounting holes and the rear mounting plate dimensions are shown in the figure below. It is highly recommended that any mounting scheme allow for vertical adjustment so the dispensing tip to dispensing surface can be easily adjusted.
1. **Power switch** – Turns on/off device power
2. **Fluid Pressure gauge** – Displays fluid delivery pressure
3. **LCD display** – Displays the program parameters
4. **Trigger LED** – Turns on when dispensing
5. **Trigger switch** – Activates current recipe displayed on LCD once
6. **Jet Pressure gauge** – Displays jet actuation pressure
7. **Jet Pressure regulator** – Regulates the jet actuation pressure
8. **Temperature controller** – controls the temperature of the dispensing nozzle
9. **Keypad** – Moves the cursor on the LCD display and changes the parameter values
10. **Fluid Pressure regulator** – Regulates the fluid delivery pressure
11. **Air switch** – Turns on and off the fluid delivery pressure
2.7. EQ VA30 Jet Valve Controller Rear View

12 **Air inlet** – This port should be connected to the source pressure with a 6mm Ø hose

13 **Jet Pressure outlet** – This port provides air pressure for the valve and should be connected with a 6mm Ø hose

14 **Fluid Pressure outlet** – This port provides fluid delivery air pressure and should be connected to the fluid syringe with a 4mm Ø hose

15 **LCD contrast adjustment** – The adjustment changes the contrast level on the LCD display by rotating the switch with a small screwdriver

16 **AC connector with fuse** – Power is supplied here and one fuse is required. The controller can operate from 100 to 240 VAC. Operation in different countries is easily accomplished by using a locally acceptable power cord.

17 **RS-232C** – Serial communication connector

18 **Jet connector** – This connector should be connected to the valve electrical connector using the approved cable supplied with the system. This connector sends output trigger signals for the dispensing jet and heater settings.

19 **I/O connector** – This connector is used to trigger the dispensing recipes and outputs, busy flag, and error signals from the pressure gauges and heater controller.
3. Pneumatic System

Referring to Fig. 1, connect an independently regulated and filtered main air source to the rear of the controller. The air must be clean and dry, and a pressure of 70-100 psi. Normal valve air operation is usually between 40-60 psi. The EQ VA30 Jet Valve is supplied with a 6mm OD air tube and terminates with a slip connect coupler. Connect this tube to the JET connector on the rear of the controller using a 6mm OD tube.

The valve is supplied with a syringe mount that can accommodate a 10, 30, or 55cc syringe. A receiver head attaches to the syringe. If a syringe is not desired, fluid can be connected directly to the feed tube using a luer lock connector. The FLUID pressure is regulated separately from JET pressure. Maximum fluid pressure is 40 psi. However, normal operation is usually between 5-30 psi. Pressure variations in the fluid pressure source can adversely affect the drop size. The digital pressure gauges are factory set to pressure in PSI (pound/in²). To change the units and make other adjustments like error conditions please refer to Section 16 – Digital Pressure Gages.

CAUTION!
It is imperative that the air supplied to the controller is clean and dry, free from debris and water. A 40 micron filter, a water separator, and an overpressure relief valve set at around 130 psi are highly recommended. If the air is not clean and dry, serious damage can occur to the air solenoid valves. The air supply pressure should be between 70 and 100 psi.
4. Electrical Interface

There are four cable connections on the rear of the controller: Power cord, RS-232, Digital I/O and Jet Valve as shown in Fig. 2. All four cables have different connectors, so it is not possible to make improper connections to the controller when using standard cables supplied by Loctite®.

⚠️ CAUTION!
Be sure that all power is off when connecting and disconnecting any cable to the controller.

The power cord set should include a standard 3 wire (Hot, Neutral, Earth) cable, with a IEC C13 straight International Female connector on one end, and a country-specific plug at the other end.

The controller software requires an RS-232C communication interface with the EQ VA30 Jet Valve Controller.

The Jet cable is a high-density HD-15 pin cable and should be attached directly to the EQ VA30 Jet Valve and the EQ VA30 Jet Valve Controller.

The I/O cable is used by the robot controller to trigger the valve to fire a sequence of drops that were downloaded into the controller. The I/O cable should be connected directly to host robot controls. A Male DB-26 connector is required to mate with the I/O cable. The controller has an internal nonvolatile memory that retains the jet parameters that were downloaded into the controller. The controller provides 6 TTL trigger lines to control the operations of the valve.

5. Physical Placement

The controller should be placed in a location where the front panel controls may be viewed and accessed. The ventilation holes on the sides should not be blocked.
6. Dispensing Components

Referring to Fig. 3, the valve has three components in contact with the fluid: the nozzle plate (1), diaphragm (2) and the feed tube (3). The materials of these components are listed below. These components can be easily disassembled with two screws, cleaned and reused (see Appendix 2). The diaphragm should be inspected each time the nozzle plate is removed. If there are signs of wear or deformation, the diaphragm should be replaced.

**CAUTION!**

**Important:** Fluids that could damage the jet’s wetted parts (17-4 stainless steel, tungsten carbide, FFKM (viton)) should not be dispensed or used for cleaning. Not recommended are anaerobic methacrylate and pre-mixed 2-part adhesives with a short pot life as these can harden in the nozzle plate. Cyanoacrylates may not be dispensed.

![Fig. 3](image)

7. Input / Output Connections

Table 1 describes the pin assignments of the custom 26 pin I/O connector. The custom 5 foot I/O cable is supplied with the controller. The I/O is configured for the inputs to be pulled down to GND. When the specific input is triggered, the controller will activate the corresponding preprogrammed Recipe # shown.

- Pins 1 through 6 of the I/O cable are outputs from the robot to the Jet Valve Controller. They can be TTL outputs capable of sinking 2 mA of current, or they can also be relay contacts.
- Pin 7 outputs a busy status flag from the Jet Valve Controller to the robot.
- Pin 8 is an external interrupt used to remotely stop a dispensing program
- Pins 9, 14 are Isolated Ground
- Pins 10-13 and 15-17 not connected
- Pins 18-26 are alarms from the heater and pressure sensors.
Table 1

<table>
<thead>
<tr>
<th>I/O</th>
<th>Pin Assignments</th>
<th>Circuitry</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Recipe 1  (Input)</td>
<td>Table 2</td>
</tr>
<tr>
<td>2</td>
<td>Recipe 2  (Input)</td>
<td>Table 2</td>
</tr>
<tr>
<td>3</td>
<td>Recipe 3  (Input)</td>
<td>Table 2</td>
</tr>
<tr>
<td>4</td>
<td>Recipe 4  (Input)</td>
<td>Table 2</td>
</tr>
<tr>
<td>5</td>
<td>Recipe 5  (Input)</td>
<td>Table 2</td>
</tr>
<tr>
<td>6</td>
<td>Recipe 6  (Input)</td>
<td>Table 2</td>
</tr>
<tr>
<td>7</td>
<td>Busy Flag  (Output)</td>
<td>Table 3</td>
</tr>
<tr>
<td>8</td>
<td>External Interrupt (Input)</td>
<td>Table 2</td>
</tr>
<tr>
<td>9</td>
<td>GND</td>
<td></td>
</tr>
<tr>
<td>10-13</td>
<td>N/C</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>GND</td>
<td></td>
</tr>
<tr>
<td>15-17</td>
<td>N/C</td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>Heater Alarm Common  (Output)</td>
<td>Table 6</td>
</tr>
<tr>
<td>19</td>
<td>Fluid Pressure Alarm Common  (Output)</td>
<td>Table 5</td>
</tr>
<tr>
<td>20</td>
<td>Fluid Pressure Alarm 2  (Output)</td>
<td>Table 5</td>
</tr>
<tr>
<td>21</td>
<td>Fluid Pressure Alarm 1  (Output)</td>
<td>Table 5</td>
</tr>
<tr>
<td>22</td>
<td>Air Pressure Alarm Common  (Output)</td>
<td>Table 4</td>
</tr>
<tr>
<td>23</td>
<td>Air Pressure Alarm 2  (Output)</td>
<td>Table 4</td>
</tr>
<tr>
<td>24</td>
<td>Air Pressure Alarm 1  (Output)</td>
<td>Table 4</td>
</tr>
<tr>
<td>25</td>
<td>Heater Alarm 1  (Output)</td>
<td>Table 6</td>
</tr>
<tr>
<td>26</td>
<td>Heater Alarm 2  (Output)</td>
<td>Table 6</td>
</tr>
</tbody>
</table>

**Input-Output Interface**

The custom I/O connector connects to one type of input circuit and four types of output circuits. The design notes suggest at least one interface circuit on the user’s side of each type of input or output.

As a general rule, a good interface should provide level shifting and galvanic isolation between the jet controller and the robot. Galvanic isolation enhances noise immunity between the jet controller and the robot.

For true galvanic isolation when using opto-isolators, it is necessary to use two independent power supplies, one on the input side, and one on the output side. If the input-side ground is connected to the output-side ground, or if there is only one power supply, there is no ground isolation, and the “opto-isolator” is reduced in functionality to a simple level shifter.
Suggested external circuitry to drive a digital input on the Jet Controller.

<table>
<thead>
<tr>
<th>Jet Controller Digital Input circuitry, for J7, pins 1, 2, 3, 4, 5, 6, 8</th>
</tr>
</thead>
<tbody>
<tr>
<td>+5V</td>
</tr>
<tr>
<td>27K</td>
</tr>
<tr>
<td>100K</td>
</tr>
<tr>
<td>D-IN</td>
</tr>
<tr>
<td>J7-9</td>
</tr>
<tr>
<td>J7-1,2,3,4,5,6, or 8</td>
</tr>
<tr>
<td>USER-OUT</td>
</tr>
</tbody>
</table>

- The User should select an opto-isolator that interfaces well with the user’s circuitry.
- The LED of the opto-isolator should be driven in a manner consistent with the user’s circuitry.
- All relays and opto-isolators introduce a time delay in the signal path. When using opto-isolators, select devices which introduce minimal delays.
- The digital inputs of the jet controller are configured to provide +5VDC pullup voltages.
- The inputs are protected for voltages up to 36 V DC.
- The switching threshold is typically 1.4 V/1.9 V.

Table 2
Jet Controller Digital Output circuitry, for J7, pin7

Circuitry to drive a digital input on the user’s machine.

- Software-configurable I/O channels may be configured as sinking digital outputs (D-OUT) up to 36 V, 200 mA each.
- Note: an external voltage, Vcc, up to 36 VDC will not harm the input circuitry (D-IN) which is also connected to each output pin.

- The User should select an opto-isolator and pullup resistor (R1) that interfaces well with the user’s circuitry.
- Vcc may be any voltage between +5 and +24 VDC.
- All relays and opto-isolators introduce a time delay in the signal path. When using opto-isolators, select devices which introduce minimal delays.

Table 3
Jet Controller Air Pressure Alarm Output circuitry for J7, pins 23 and 24.

External user’s circuitry to drive digital inputs on the user’s machine.

- NPN open collector max. 100 mA
- (40 V max.)
- residual voltage 1 V max.,
- 2 outputs (NO/NC switchable)

- The User should select opto-isolators and pullup resistors that interface well with the user’s circuitry.
- Vcc may be any voltage between +5 and +24 VDC.
- All relays and opto-isolators introduce a time delay in the signal path. When using opto-isolators, select devices which introduce minimal delays.

Table 4
Jet Controller Fluid Pressure Output circuitry, for J7, pins 20 and 21

| External user’s circuitry to drive a digital input on the user’s machine. |
| --- | --- |
| +Vcc | J7-21 |
| J7-20 | GND-24 |

- NPN open-collector max. 100 mA
- (40 V max.)
- Residual voltage 1 V max.
- 2 outputs (NO/NC switchable)

- The User should select opto-isolators and pullup resistors that interface well with the user’s circuitry.
- Vcc may be any voltage between +5 and +24 VDC.
- All relays and opto-isolators introduce a time delay in the signal path. When using opto-isolators, select devices which introduce minimal delays.

Table 5
Jet Controller Heater alarm Output circuitry, for J7, pins 18, 25, 26

| External user’s circuitry to drive a digital input on the user’s machine. |
| --- | --- |
| ![Diagram](image) |

- The Normally Open contact is engaged when an error occurs.
- The contact material of the relay is Silver Tin Oxide. The pullup resistor of the opto-isolator should be selected to produce 15 to 20mA through the contacts.
- The tin oxide makes the material more resistant to welding at high making current peaks. It has a very high burn out resistance when switching high loads. It has a low degree of material migration under DC loads. It is useful where very high inrush currents occur, such as lamp loads including fluorescent.
- The User should select opto-isolators and pullup resistors that interface well with the user’s circuitry.
- Vcc may be any voltage between +5 and +24 VDC.
- ALTERNATE INTERFACE: Due to the inherent galvanic isolation provided by the electro-mechanical relay you may replace the opto-isolator with a simple buffer followed by a hardware de-bounce circuit or a software de-bounce routine.

Table 6
8. EQ VA30 Jet Valve Controller Front Panel

8.1. Jet and Fluid Pressure Regulator

The controller has integrated air regulators (7, 10) which control the pressure to the Jet and the Fluid supply. Two digital gauges (2, 6) indicate the pressure levels. An air switch (11) allows you to turn the Fluid Pressure off. This is very convenient when changing fluid or cleaning the valve.

**IMPORTANT:**
The Jet Pressure needs to be above 35 psi for the valve to operate correctly.

8.2. Temperature Controller

The main menu of the temperature controller displays the present temperature (PV) on the top line, and the set point temperature (SV) on the bottom line of the display.

- is the ENTER key
- is the INDEX key
To change the SV temperature, use the UP/DOWN arrows to increase/decrease the temperature. For example, to change SV from 20 to 45 degrees, use the UP arrow to increase the SV value until it is at 45, then press the ENTER key to save the change.

To turn ON the heater,
- Press the INDEX key until you see the Run-Stop Output Control screen (r-5) on the top line of the display.
- Now use the arrow key to select run setting to turn ON the heater as shown by the figure below.
- Then press the ENTER key to save the change. Now the heater is turned ON.
- Press ENTER key again to return to the main screen display.

To turn OFF the heater,
- Press the INDEX key until you see the Run-Stop Output Control screen (r-5)
- Now use the arrow key to select Stop setting to turn OFF the heater.
- Then press the ENTER key to save the change. Now the heater is turned OFF.
- Press ENTER key again to return to the main screen display.
See the **Heater Options** in **Section 13** for details on how to change the heater settings from the program. Also, see **Section 15** for the technical specifications.

### 8.3. LCD Display Functions and Selection Keys:

There are 8 settings available on the main LCD menu. The UP/DOWN keys are used to increment the values in the settings. The LEFT/RIGHT keys are used to select the settings. The selected setting is indicated by a blinking cursor. The following is a description of the 8 settings:

- **Recipe** - You can have up to 6 timing recipes saved in the controller
- **Trigger** - You can choose between PULSE and LEVEL for Trigger Mode
- **Jet** - Use this option to CLOSE or OPEN the valve
- **Htr Timer (min)** - Setting a value \( n \) greater than zero will cause the controller to turn off the Heater after \( n \) minutes of idle time
- **Refill (msec)** - Specify the Refill Time in msec for Recipe \( n \)
- **Dwell (msec)** - Specify the Dwell Time in msec for Recipe \( n \)
- **Refill+** - is equivalent to the Add XX ms in the Timing Recipes menu (see **Section 3.3**). Also, refer to **Appendix 1** - First Drop Compensation.
- **Drops** - Specify the number of drops to be repeated. For example, if you want a single drop per trigger signal, then enter 1. If you want 10 drops to be dispensed per trigger signal, enter 10.

**NOTE:** To set the additional parameter **Refill ++**, you will press the LEFT and RIGHT keys **simultaneously** below the LCD display and the following screen will appear on the LCD display: Refer to **Appendix 1** - First Drop Compensation.

The **RCP:** option selects the timing recipe from #1 to #6. The **AFTER:** and **REFILL++:** values are equivalent to the **Add XX msec after YY seconds** in the Timing Recipes menu (see **Section 13.3**).
Once you make the changes, you should press the LEFT and RIGHT keys simultaneously twice to accept the new settings, and the LCD display will return to the main menu. Note that on the first press, the LCD display will change to the RS232 menu (see Section 8), and then to the main menu on the second press.

**IMPORTANT:**

If you make changes to values using the front panel display, the changes will not be reflected back to the Loctite® controller program. Also, the values can be overwritten each time you start the Loctite® program. The warning will be displayed. Please write down your changes and then enter them into the software to synchronize.

### 8.4. Trigger Button and LED

- **Trigger Button (5):** Press the button to immediately trigger the current recipe # displayed on the LCD screen. If there were multiple drops specified in the recipe #, then multiple drops will be dispensed.

- **Output (4):** The Output light is on when the controller is firing so you can verify a signal was sent to the valve. The light is off when the valve is in idle state.

### 9. Serial Communication

- **RS232:** There is serial port DB 9P Female connector located on the front panel. You can use a USB to Serial Adapter cable to connect your PC to the controller. You simply connect the USB Plug end of the cable into your PC’s USB port, and connect the Serial DB9 plug of the cable to this RS232 port. The default settings for the RS232 data interface are as follows:

  - CTS ON for hardware handshake
  - Baud Rate - 57600
  - Parity – NONE
  - Data Length - 8BIT

To change the default RS232 settings, you will press the LEFT and RIGHT keys simultaneously twice and the following settings will appear on the LCD display:
You can use the LEFT/RIGHT keys to move from one selection to another on the display, and the UP/DOWN keys to change the selected setting. The selected setting will have a blinking cursor.

The CTS state is either ON or OFF. Set CTS to ON if you wish to use hardware handshake. You can select 57600, 19200, 9600 or 4800 for Baud Rate. For Parity, you can select NONE, EVEN or ODD. For Data Length, you can select either 8BIT or 7BIT.

Once you make the changes for the RS232 interface, you should hold the LEFT and RIGHT keys simultaneously to accept the new settings, and the LCD display will return to the main menu.

**IMPORTANT:**
Remember to check the RS232 settings in the controller program. The settings in the controller should be the same as the settings in the program (see Section 13.2). The program and the controller will not be able to communicate with each other when they have different RS232 settings.

10. **Assembling the EQ VA30 Jet Valve**

The valve is shipped fully assembled less a nozzle plate. Depending on the application and dispensing fluid the nozzle plate orifice diameter should be chosen (ordered separately). The steps required to correctly assemble the diaphragm and nozzle plate to the valve body are listed below. Referring to Fig. 4a below, the heater block (1), the diaphragm (2), and the nozzle plate (3) are shown. There is a groove feature on the bottom face of the heater block that matches with the raised bosses on the diaphragm and will locate the diaphragm correctly on the heater block. The diaphragm also has a metal insert with a post that must be inserted into the central hole on the heater block. Although a diaphragm can be inserted without the valve connected to the controller, it will not sit flat on the heater. It is recommended to connect both the electrical and pneumatic connections to the controller, set the jet pressure regulator to 40 psi (.28 Mpa) and using the front panel LCD set the Jet Value (4) to OPEN as shown in Fig. 4b.

For ceramic nozzle plates, an additional o-ring is required. The o-ring fits inside the groove on the nozzle plate facing the diaphragm.

---

**Fig. 4a**
Once the Jet value has been set to OPEN, you should hear the valve actuate. The diaphragm can be inserted into the heater block as shown in Fig. 5a. The nozzle plate can now be attached to the heater block as is shown in Fig. 5b. The nozzle plate has two locating pins that will guide the nozzle plate onto the heater block. Be sure the fluid barb (5) is facing toward the fluid syringe. The feed tube (6) can be attached to the fluid barb on the nozzle plate once the nozzle plate is secured.

Once the nozzle plate has been positioned on the heater block, it must be secured using two captive screws located in the holes shown in Fig. 6 using the 3mm hex driver (8) supplied with the valve. Insert the hex driver into the two holes (7) and tighten until the nozzle plate is secure. The valve is now ready for priming.
11. Checking for Fluid Leaks

- Before you actually run a program, it is important to check for fluid leaks. Assemble the diaphragm and nozzle plate to the valve per the directions above. Fill a syringe with fluid and attach to the Feed Tube. Connect the receiver head to the syringe and turn on the controller. Set the fluid air pressure to 10 psi (.070 Mpa) and the Jet pressure to 45psi (.320 Mpa). The fluid should not drip through the orifice. If fluid is leaking through the nozzle tip when the valve is closed, check to see if the Jet pressure is set to at least 35psi. Increase the pressure to 60psi and check to see if the leak stops. If the leak continues, the Diaphragm or Nozzle Plate is likely damaged or dirty and should be cleaned or replaced.

There are several areas to check for fluid leaks:

- Fluid can leak out the luer fitting that attaches the syringe to the Feed Tube. Sometimes the luer fitting is a little snug and hard to twist in completely. If fluid is leaking, give the fitting an extra turn to seat it completely. If this does not solve the leaking, change the Feed Tube and/or the syringe and check again.

- Fluid can leak at the junction between the Feed Tube and the Nozzle Plate inlet fitting. The Feed Tube is connected using a standard barb to the inlet fitting. If fluid is leaking at the barb end of the fitting, replace the Feed Tube.

- Check for leaks between the Diaphragm and the Nozzle Plate. The Nozzle Plate must be attached correctly with screws tighten well. Make sure the Jet is closed on the controller. If you observe fluid leaking under the diaphragm, then the jet has not been assembled correctly. Disassemble the dispensing components and inspect and/or replace the Diaphragm as required.

Check to see if fluid leaks out the two holes in the heater block shown below. If fluid is leaking, the diaphragm is missing or the diaphragm is damaged and should be replaced.

**IMPORTANT:**

⚠️ If fluid leaks between the Diaphragm and the Nozzle Plate, the jet will not function correctly. In fact, dispensing should be discontinued and the components should be cleaned or replaced as required.
12. Application Notes

12.1. Material Effects on Jetting Quality

The EQ VA30 Jet Valve works on the principle of rapidly changing the momentum of a minute volume of fluid to eject a drop of material. Like all jetting systems, the state of the product is extremely important for high-quality dispensing. In the case of an ink jet printer, the ink is carefully package to ensure there is no trapped air in the cartridge and the rheology of the ink is carefully controlled by the manufacturer for successful jetting. The EQ VA30 Jet Valve on the other hand is designed to dispense a wide variety of fluids. However, not all fluids can be successfully dispensed using a jetting system. In general there are several areas to consider when choosing a product to jet dispense.

- Very compliant fluids or fluids with large amounts of dissolved gas are problematic and care should be taken to prepare the material for dispensing. If the fluid contains a large amount of dissolved gas, it is likely that the gas will come out of solution and form bubbles. Bubbles in the fluid path will cause erratic dispensing and missed drops. Make sure all material is carefully degassed. If you are using a batch reservoir, make sure the fluid is not open to air after degassing or the air will quickly be reabsorbed into the fluid. It is also highly recommended when using fluids with entrapped air or gas that a frequent purging is done to expel any air collecting in the fluid path. It is best however, never to have the bubbles introduced into the fluid path by carefully degassing the material.

- Fluids with very high surface tension can also be problematic as they tend to form “satellites”. Satellites are very small droplets that are sometimes formed during the jetting process. These satellites fly off in many directions even backwards toward the dispensing tip. If the satellites stick to the dispensing tip, they can build up and attract more satellites. Eventually, the tip has a glob of fluid on the tip that can interfere with the quality of the dispensing. It is recommended that the lowest jet air pressure as possible be used. Limiting the jet air pressure has the effect of reducing the energy imparted to the fluid which can reduce the production of satellites. Also, it is highly recommended that the tip be located over a “service station” when not actually dispensing. A well designed service station should have a slight vacuum which can clean material off the tip as well as provide a cup for purging fluid as described above.

- High viscosity fluids often require the addition of heat to facilitate jetting. If the material you are using does not eject a drop, heat may be needed. The EQ VA30 Jet Valve has an internal heater and integrated heater controller which can elevate the fluid temperature. Only the fluid inside the nozzle plate is heated. It is rarely required to heat the fluid reservoir. The heat addition is often the solution for hard to dispense materials. When using heat be sure not to heat the material so high as to cure it inside the nozzle plate. For help with settings for a variety of fluids, please refer Section 11 - Application Notes.

The EQ VA30 Jet Valve has an adjustment to change the amount of energy imparted during jetting. The factory default setting is generally sufficient to provide enough energy for most materials. However, some materials will need additional energy and some materials will need less energy for reliable jetting.
12.2. Selecting a Nozzle Size

The first step in the process is to pick a nozzle size that will give you approximately the desired drop volume or drop diameter. Some customers will specify a drop diameter and others will specify a drop weight.

- Drop diameter is highly dependent on the surface tension of the material and the wetting characteristic of the substrate and therefore not always straightforward to determine. For example, epoxy such as SMA is designed to stand up and has a “tall” drop profile resulting in a small diameter to weight ratio.

- Underfill material is designed to wick into small gaps and tends to spread out and form a larger, “flat” drop profile resulting in a large diameter to weight ratio.

We always recommend using drop weight when initially qualifying a new material. Therefore, weighing 100 or 200 drops on a scale is the most reliable method to determine the drop weight. Alternatively, drop dispensed on pre-weighed slides also works well. The following table can be used as guide for initial selection of nozzle size.

<table>
<thead>
<tr>
<th>Nozzle ID</th>
<th>Mass (SG = 1)</th>
<th>Substrate Dot Diameter (90 degree Contact Angle)</th>
</tr>
</thead>
<tbody>
<tr>
<td>75 μm</td>
<td>5 – 25 μg</td>
<td>270– 460 μm</td>
</tr>
<tr>
<td>125 μm</td>
<td>25 – 80 μg</td>
<td>460 – 580 μm</td>
</tr>
<tr>
<td>200 μm</td>
<td>80 – 160 μg</td>
<td>725 – 850 μm</td>
</tr>
</tbody>
</table>

Contact Angle 90
Specific Gravity 1

<table>
<thead>
<tr>
<th>Dot Dia (um)</th>
<th>Dot Height (um)</th>
<th>Alpha (radians)</th>
<th>Dot Volume (nl)</th>
<th>Dot Mass (ug)</th>
</tr>
</thead>
<tbody>
<tr>
<td>100</td>
<td>50.0</td>
<td>0.00</td>
<td>0.262</td>
<td>0.262</td>
</tr>
<tr>
<td>110</td>
<td>55.0</td>
<td>0.00</td>
<td>0.348</td>
<td>0.348</td>
</tr>
<tr>
<td>120</td>
<td>60.0</td>
<td>0.00</td>
<td>0.452</td>
<td>0.452</td>
</tr>
<tr>
<td>130</td>
<td>65.0</td>
<td>0.00</td>
<td>0.575</td>
<td>0.575</td>
</tr>
<tr>
<td>140</td>
<td>70.0</td>
<td>0.00</td>
<td>0.718</td>
<td>0.718</td>
</tr>
<tr>
<td>150</td>
<td>75.0</td>
<td>0.00</td>
<td>0.884</td>
<td>0.884</td>
</tr>
<tr>
<td>160</td>
<td>80.0</td>
<td>0.00</td>
<td>1.072</td>
<td>1.072</td>
</tr>
<tr>
<td>170</td>
<td>85.0</td>
<td>0.00</td>
<td>1.286</td>
<td>1.286</td>
</tr>
<tr>
<td>180</td>
<td>90.0</td>
<td>0.00</td>
<td>1.527</td>
<td>1.527</td>
</tr>
<tr>
<td>190</td>
<td>95.0</td>
<td>0.00</td>
<td>1.796</td>
<td>1.796</td>
</tr>
<tr>
<td>200</td>
<td>100.0</td>
<td>0.00</td>
<td>2.094</td>
<td>2.094</td>
</tr>
</tbody>
</table>
12.3. Diaphragm

We are currently using one diaphragm material: Fluoroelastomer (Viton). In most cases the chemical compatibility of the diaphragm and the fluid is determined by the solvent in the fluid. The chemicals in the material can be found in the Material Data Safety Sheet (MSDS). The table (next page) shows typical chemical compatibilities. In some cases even if there is an incompatible solvent in the fluid, it might not affect the diaphragm. The best way to insure compatibility is to leave the material in the valve for 24-48 hours and inspect the diaphragm for swelling. If there is any swelling, then the diaphragm material is incompatible with the fluid.

**IMPORTANT:**

If unsure of the proper choice of diaphragm materials, please contact Henkel for recommendations. In general, if the diaphragm material is incompatible with the fluid, the diaphragm will exhibit slight swelling around the metal insert. If swelling occurs, the performance of the valve will be adversely affected.

<table>
<thead>
<tr>
<th>Chemical</th>
<th>FFKM Diaphragm Compatibility</th>
</tr>
</thead>
<tbody>
<tr>
<td>Benzene</td>
<td>Yes</td>
</tr>
<tr>
<td>Cyclohexane</td>
<td>Yes</td>
</tr>
<tr>
<td>Cyclohexanol</td>
<td>Yes</td>
</tr>
<tr>
<td>Dimethyl Formaide</td>
<td>No</td>
</tr>
<tr>
<td>Ethanol</td>
<td>No</td>
</tr>
<tr>
<td>Heptane</td>
<td>Yes</td>
</tr>
<tr>
<td>Hexane</td>
<td>Yes</td>
</tr>
<tr>
<td>Isopropanol</td>
<td>Yes</td>
</tr>
<tr>
<td>Pentane</td>
<td>Yes</td>
</tr>
<tr>
<td>Silicone Oil</td>
<td>Yes</td>
</tr>
<tr>
<td>Terpineal</td>
<td>Yes</td>
</tr>
<tr>
<td>Toluene</td>
<td>Yes</td>
</tr>
<tr>
<td>Xylene</td>
<td>Yes</td>
</tr>
</tbody>
</table>
12.4. Dispensing Temperature

In order to get reliable and repeatable dispensing, the drop must eject out of the nozzle forcefully and cleanly. If the jet does not have adequate energy to break off cleanly, it forms multiple small drops or “tails” that will cling to the nozzle tip and eventually completely block the orifice. This phenomenon is called “accumulation”.

Temperature is the most important parameter to get an excellent and reliable jetting condition. The goal is to heat the fluid to lower its viscosity so it flows through the nozzle, as well as enabling the jet to break off cleanly. You can select the temperature based on the viscosity of the material, but viscosity is not always the only factor. Generally, the higher the viscosity, the higher the temperature required for high-quality jetting. However, the rheology of the material is important. Some materials are “stringy” and need a higher temperature to jet cleanly. Table below shows examples of material viscosity and approximate temperature settings.

<table>
<thead>
<tr>
<th>Fluid Type</th>
<th>Viscosity</th>
<th>Temp</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>cps</td>
<td>°C</td>
</tr>
<tr>
<td>Hyso1® 3800</td>
<td>300</td>
<td>35</td>
</tr>
<tr>
<td>Loctite® 3621</td>
<td>50K</td>
<td>45</td>
</tr>
<tr>
<td>Loctite® 3103</td>
<td>10K</td>
<td>60</td>
</tr>
<tr>
<td>Loctite® 3046</td>
<td>5-18K</td>
<td>60</td>
</tr>
</tbody>
</table>
12.5. Fluid Pressure (FP)

Another important jet parameter is the Fluid Pressure. The fluid reservoir (the syringe) must supply enough fluid to the valve chamber to generate clean drop formation. The criterion is that the fluid must flow out of the nozzle freely when you open the valve. As a general rule, a higher fluid pressure is more desirable than lower pressure. However, the material rheology has a big effect on how the fluid flows out of the nozzle. Refer to Section 12.7 for a table with typical Fluid Pressure settings.

The following pictures describe the 4 different typical flow patterns when the valve is open and Fluid Pressure is applied.

**Stream:**
The first example is a material that flows freely and forms a stream. Many low viscosity epoxies will form a stream. For example a low viscosity underfill like Hysol® 3800 will form a stream, while a low viscosity UV epoxy will not. Set the Fluid Pressure to the minimum value that allows a clean stream to form.

**Drop:**
Some materials form drops of fluid rather than a stream. These fluids tend to be higher viscosity and will not stream. A good rule of thumb is to set the Fluid Pressure so you have about 1 drop/sec. Many highly filled underfill epoxies exhibit this flow pattern.

**Curl:**
Other fluids will form a stream, but are “stringy” enough that they will curl at the end of the stream. A good example of this behavior is Loctite® Chipbonder 3621. A good rule of thumb is to set the Fluid Pressure so that the stream flows cleanly and don’t worry about the curl at the end.

**Pool:**
Another type of fluid will not drop or stream. These fluids are very “stringy” and will form a “pool” of fluid around the nozzle tip very similar to accumulation that occurs when a jet is not performing correctly. A good rule of thumb is to set the Fluid Pressure so that a 3mm pool forms in 5 seconds.
12.6. Jet Pressure (JP)

Jet Pressure is the key parameter for drop quality and is very important for accumulation-free jetting. Accumulation is a condition where the jet does not break off cleanly into a drop leaving material to build up on the nozzle tip. There is a minimum Jet Pressure setting necessary where the exit velocity of the jet allows clean break off. After the minimum Jet Pressure is reached, increasing the Jet Pressure can generate too forceful a jet and produce unwanted splashes, Fig 7b. Also, smaller drops, called satellites Fig. 7a, can form with too high a Jet Pressure setting.

<table>
<thead>
<tr>
<th>Fluid Type</th>
<th>Viscosity</th>
<th>Nozzle</th>
<th>Temp</th>
<th>Jet Pressure</th>
<th>Speed</th>
<th>Drop weight / Drop size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Loctite® 3621</td>
<td>50K</td>
<td>125</td>
<td>45</td>
<td>0.35</td>
<td>100</td>
<td>32 / -</td>
</tr>
<tr>
<td>Loctite® 3103</td>
<td>8 – 14K</td>
<td>200</td>
<td>60</td>
<td>0.40</td>
<td>3</td>
<td>- / 1.3</td>
</tr>
<tr>
<td>Loctite® 3046</td>
<td>5 – 18K</td>
<td>75</td>
<td>60</td>
<td>0.25</td>
<td>3</td>
<td>- / 0.58</td>
</tr>
</tbody>
</table>

There is no magic number for the Jet Pressure because it is so dependent of the viscosity and surface tension of the material. The best technique is to start with a midpoint and adjust the Jet Pressure for the best drop quality without accumulation. In general, 0.310 Mpa (45psi) is a good starting point for the Jet Pressure. If the jet does not break off cleanly, increase the Jet Pressure. A symptom of poor break off is accumulation. Sometimes reducing the Jet Pressure can eliminate accumulation if the jet velocity is too high and many satellites are formed. In this case, lower the Jet Pressure and see if the accumulation goes away. The jet requires a minimum of 0.240Mpa (35psi) to function correctly. You should not run below this value. If you increase the Jet Pressure as high as 0.45Mpa (65psi) and still have accumulation, you can try a higher Temperature. Shown above are typical Air Pressure settings.
12.7. Refill Time

The Refill Time is a major factor in determining the drop volume. Refill Time is the “open” time of the valve when fluid flows into the orifice. It is important to allow enough time for the fluid to flow into the nozzle otherwise the valve will be “starved”. If there is too much fluid flowing into the nozzle, the drop will be too big to jet and accumulation will occur. If the drop volume is too high, reduce the Refill Time, if too low, increase the Refill Time. If you are not able to get the proper drop volume; you can change the Nozzle Size or the Fluid Pressure. The speed of the jet in Hertz (Hz) is defined as:

\[
\text{Drop Speed (Hz)} = \frac{1}{(\text{Refill} + \text{Dwell}) \text{ seconds}}
\]

- 50 Hz = 1 / (.005 + .015)
- 100 Hz = 1 / (.003 + .007)
- 200 Hz = 1 / (.002 + .003)
- 303 Hz = 1 / (.0016 + .0017)

At low speeds, < 50 Hz, the Refill Time should be a minimum of 3 msec. As the speed increases, > 100 Hz, you can reduce the Refill Time to 2 msec. At high frequency, > 250 Hz, you can use a refill of 1.7 msec. Many viscous fluids tend to “shear thin” when operating at high speed, and because of shear thinning, the drop volume sometimes increases with speed for a given refill time. The Table below shows typical Refill Times for different fluids.

**Note:** The minimum refill time is 1.7 msec and is dependent on the fluid. A shorter refill time will probably fail to produce drops.

<table>
<thead>
<tr>
<th>Fluid Type</th>
<th>Viscosity</th>
<th>Nozzle</th>
<th>Temperature °C</th>
<th>Refill ms</th>
<th>Dwell ms</th>
<th>Speed Hz</th>
<th>Dot wt / size µm / mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Loctite® UV9060F</td>
<td>11K (tx)</td>
<td>75</td>
<td>45</td>
<td>2.0</td>
<td>3.0</td>
<td>200</td>
<td>- / 0.35</td>
</tr>
<tr>
<td>Loctite® 3621</td>
<td>50K</td>
<td>125</td>
<td>45</td>
<td>2.0</td>
<td>8.0</td>
<td>100</td>
<td>32 / -</td>
</tr>
<tr>
<td>Loctite® 3103</td>
<td>8 – 14K</td>
<td>200</td>
<td>60</td>
<td>9</td>
<td></td>
<td>3</td>
<td>- / 1.3</td>
</tr>
</tbody>
</table>
12.8. Dwell Time

The minimum Dwell Time is the time needed for a drop to be ejected from the nozzle tip once the diaphragm hits the nozzle seat. The Dwell Time is generally not important if you are dispensing in “Drop Mode”. Drop Mode is when you jet a single drop of fluid, move to the next position and jet another drop. The motion of the robot will always take longer to move from position to position than the valve will need for the drop to eject. However, in “Line Mode or Level Mode”, the Dwell Time is important. As shown above, the speed of the jet is determined by the sum of the Refill and Dwell Time. Often, a faster jet speed produces less accumulation. So, in general you want to make the Dwell Time as small as possible with the minimum being 1.5 msec. Of course, settings are dependent on material. For example, a very thick, stringy material cannot run faster than 20 Hz, while a thin material like Hysol® 3800 can run at 300 Hz. A good rule of thumb is to start with a Dwell Time of 3-8 msec. When in Line/Level Mode the speed of the jet is used to calculate the velocity of the robot as shown below. Examples are shown below.

The Robot Velocity \( V \) (mm/sec) = \( \frac{\Delta X}{\Delta T} \)

Where: \( \Delta X \) = the drop spacing
\( \Delta T = (\text{Refill Time} + \text{Dwell Time}) \)

\( \Delta X = 0.05 \text{ mm} \)
\( \Delta T = (0.002 + 0.003) = 200 \text{ Hz} \)

\( V = 100 \text{ mm/sec} \)

\( \Delta X = 0.025 \text{ mm} \)
\( \Delta T = (0.0017 + 0.0016) = 303 \text{ Hz} \)

\( V = 75.8 \text{ mm/sec} \)
### Summary of Typical Parameters and Their Effects

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Effects</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Nozzle Size</strong></td>
<td></td>
</tr>
<tr>
<td><strong>μm</strong></td>
<td><strong>Drop weight</strong></td>
</tr>
<tr>
<td>75</td>
<td>5-25</td>
</tr>
<tr>
<td>125</td>
<td>25-80</td>
</tr>
<tr>
<td>200</td>
<td>80-200</td>
</tr>
<tr>
<td><strong>Temperature</strong></td>
<td></td>
</tr>
</tbody>
</table>
| | • It lowers the viscosity of the fluid, and makes it easier to flow.  
| | • Higher temperature allows a cleaner break off and less accumulation.  
| | • “Stringy” materials require higher temperature.  
| | • However, too high a temperature produces splashes.  
| **Fluid Pressure** | |
| | • Higher Fluid Pressure produces bigger dots.  
| | • Thicker fluids need higher Fluid Pressure. Use the combination of Temperature and Fluid Pressure to control the Flow Rate.  
| | • Good Flow Rate is important for reliable jetting.  
| **Jet Pressure** | |
| | • Jet Pressure (JP) is the key parameter to get good Jet Velocity.  
| | • Good Jet Velocity produces clean jetting without accumulation.  
| | • Minimum JP is 0.24 Mpa (35psi). Maximum JP is 0.45 Mpa (65psi).  
| | • If the jet accumulates, increase JP. However, too high a JP can produce satellites.  
| | • If JP is as high as 0.45 Mpa and you still have accumulation, you should increase the Temperature.  
| | • If JP is as high as 0.45 Mpa and the jet won’t break off, you might need to increase the Impact Gap.  
| | • Higher JP will decrease the dot weight, and lower JP will increase the dot weight. If you want to maintain the same dot weight, you will need to change the fluid pressure accordingly.  
| **Refill Time** | |
| | • Longer Refill Time produces bigger dots.  
| | • The combination of Fluid Pressure and Refill Time control the dot size.  
| | • 2 msec is a good starting point. Increase or decrease as needed.  
| | • Decrease Refill Time if you need to go faster than 250 Hz.  
| | • Minimum refill time is 1.7 msec  
| **Dwell Time** | |
| | • Dwell Time has no effect in DOT mode.  
| | • The Dwell time controls the jetting speed in LINE or LEVEL mode.  
| | • Higher jetting speed produces higher Jet Velocity, and cleaner jetting.  
| | • Speed = 1 / (Refill + Dwell)  
| | • For example:  
| | • 100 Hz = 0.002msec + 0.008 msec = 0.003msec +0.007  
| | • 200 Hz = 0.002msec + 0.003 msec = 0.003msec +0.002  
| | • 303 Hz = 1.7 msec + 0.0016 msec
13. **Installing Loctite® Software**

Insert the installation CD or obtain a link to download the Loctite® EQ VA30 Jet Valve Controller program from the Loctite® website www.equipment.loctite.com and follow the installation instructions below.

Run 8904262 VA30 Controller Program LoctiteEQVA30.exe and follow the installation instructions.

14. **Loctite® Software**

14.1. **Starting Up the Software**

1. The Loctite® Software will run on Windows XP, Vista or Windows 7 or 8. Once the software is installed, connect the RS-232C cable from the PC to the controller, connect air lines as shown in Fig. 2, and connect jet cable to the controller. Turn on the controller and set the Jet Pressure to 40psi (.28 Mpa).

2. Run the Loctite® software by clicking on the **LoctiteEQVA30** entry in the Start Programs menu. You can also create a shortcut for this program.

3. On startup, the Loctite® Software program will poll the EQ VA30 Jet Valve Controller and automatically establish the RS-232C port and connection. A “Failed to find COM port for Loctite® Controller” message will appear if the program cannot establish communication with the controller. If this message appears, check the RS-232 cable to make sure the connection between the PC and the controller is done properly (see Section 9 for RS-232C settings).

The **Settings** menu will appear as shown in Fig 7. Check to see that the Controller Status (11) indicates: **Ready** and the Jet button on the Valve Status (1) bar is **Red**. The controller program is now enabled and ready to go.

![Fig. 7](image-url)
14.2. Settings Menu

Listed below are the options (by number) available from the Settings Menu (Fig. 7)

1. **Valve Status:** You can turn the valve ON or OFF by clicking on the large indicator button (RED = ON, BLUE = OFF). The valve is ON by default at startup. When the button is RED, the valve is activated and it will block the fluid flow. If the button is BLUE, the valve is OFF and fluid will flow freely. Generally, the user should rarely have to activate the valve manually.

2. **Recipe #1 to Recipe #6:** You can program up to six recipes for your controller. Each recipe consists of Refill Time, Dwell Time, and “first drop” adjustment times for Refill (see Appendix 1), number of drops to dispense, and the trigger mode. A pull down menu is located below each Recipe #. When the pull down menu is clicked, the Recipe List that you configured in the Timing Recipes menu (see Section 13.3) is displayed. Click on the arrow and chose one recipe entry from the list. For example, if you choose SMA-100Hz for Recipe #1, a caption of (2, 8) (0.5, 0.8, 20) appears next to it. The first bracket shows a refill time of 2 msec and dwell time of 8 msec. The second bracket shows that 0.5 msec will be added to the refill time for the first drop, and 0.8 msec will be added to the first drop if the idle time is greater than 20 seconds.

3. **Count:** You can specify the number of drops for the corresponding recipe. For example, if you want to do a single drop of Recipe #1, SMA 100Hz, specify 1 in the Count. If you want multiple drops then chose a number greater than one as shown for Recipe #2 (see Fig. 7).

   **Note:** refer to DROP mode programming (see Section 13.5) and LINE mode programming (see Section 13.6) on how to use the Count value to set the dispensing mode.

4. **Trigger Mode:** The Trigger Mode can be either PULSE or LEVEL. In the PULSE mode, the number of drops to dispense is specified in the Count entry. For example, a count of 5 and a PULSE Trigger Mode set in Recipe #1 will cause the valve to dispense 5 drops when the controller receives a falling edge (high to low) signal from Recipe #1 Trigger. When the Trigger Mode is set to LEVEL, the valve will dispense drops nonstop as long as the trigger signal remains low. The valve will stop dispensing once the signal returns to high. The Count entry is ignored in LEVEL mode. For example, if Recipe #1 has a Refill Time of 2 msec and a Dwell Time of 3 msec and the falling edge signal has remained low for 100 msec, then the valve will dispense 50 drops ((100/2 + 3)). Here, the Count value is ignored.

5. **Go:** Click on Go to activate a recipe manually. Remember once the recipe has been initiated, either manually or remotely by a PULSE mode trigger, the recipe will activate the exact number of times specified in Count without stopping.

6. **Trigger Map:** Displays the assignment of the trigger input to the dispensing recipes. For example, input trigger signal from I/O Pin 1 (see Fig. 8) is used to activate Recipe #1. The Busy Flag (I/O Pin 7) is an output signal that external controller/robot can use to monitor the valve value status. When the Jet is idle, the Busy Flag signal is set to high and set to low when the valve is activated. External controller/robot can use the Busy Flag signal to synchronize the timing for the next Recipe trigger.

   ![](Trigger_Assignment.png)

   **Fig. 8**
7. **Download Settings:** Click on this button to download timing recipes, drop count, trigger mode for the six recipes, and the settings for the temperature controller. The download command will overwrite the current settings in the controller.

8. **Heater Options:**
   - **Heater On:** allows you to set the heater on the controller to ON or OFF state.
   - **Set temperature to:** allows you to enter a value (in degrees Celsius) for the nozzle heater

   Heater Controller in Section 8 has instructions on changing the heater settings using the front panel keys.

9. **The Heater Off Timer:** gives you the ability to automatically turn off the heater after a specified valve idle time. This can be accomplished by setting a time in minutes. This feature is useful if materials will be adversely affected by long periods of heating. Some material can be ‘cured’ by high temperature when sitting in the nozzle chamber for a long period of idle time. A zero timer value will not activate the Heater Off timer option.

10. **RS232 Settings:** The default settings for Loctite® program and the controller are as follows:

    - CTS - ON for hardware handshake
    - Baud Rate - 57600
    - Parity – NONE
    - Data Length - 8BIT

   The value for the **COM Port** is set by the Loctite® program on startup. The program polls each COM port in your computer and looks for the controller. The program will warn the user if it fails to find the COM port for the controller. To troubleshoot, open Device Manager (Control Panel\System\Hardware\Device Manager) to view a list of hardware devices installed on your computer and properties for each device. An entry for **Ports (COM & LPT)** will appear on the Device Manager list when a USB/Serial adapter cable is installed in your PC. For example, the list below shows that your USB-to-Serial Com Port is assigned a value of 4 (COM4).

![Device Manager Screenshot](image)

11. **Check Status:** Click on this button to check on the communication status between the Loctite® program and the controller. A **Ready** status indicates that the communication is working. A **Com Port Error** or **Read Error** status indicates a RS232 cable connection failure.
14.3. Timing Recipes Menu

Before you can start dispensing, you must first create Timing Recipes for fluids you wish to dispense using the Timing Recipes Menu shown in Fig. 9. Once configured, the Timing Recipes can be downloaded into the Loctite® EQ VA30 Jet Valve Controller. Once the recipes are downloaded, the controller can be triggered remotely through digital inputs from the host controller without the Loctite® program running in the background. Several default Timing Recipes for popular fluids are provided to allow the user a quick start up.

**Timing Recipe List:** You can program up to 12 Timing Recipes. Each Timing Recipe should have a distinct and unique name. A good choice for a name would be a particular fluid/ material type (SMA-100Hz, UV-100cps, ..) or part number. These names will be used to identify fluid values and are used in the recipe list in the Settings screen (see Fig. 4).
1. **Refill Time**: Sets the *Flow* time required for the material to flow into the orifice after each drop has been ejected. Time is set in msec with 0.1 msec resolution.

2. **Reserved 2 to Reserved 5**: These timers are not used for EQ VA30 Jet Valve Controller. They are set to zero by default.

3. **Dwell Time**: Sets the time required for the material to be ejected from the orifice. Time is set in msec with 0.1 msec resolution.

4. **Adjust Refill time** for first drop: There are two time values you can use to adjust the size and quality of the first drop.
   - **Add xxx msec**: is a time value that is added to Refill Time. This value is added to every drop in DROP Mode described in (section 13.5). However, this value is added only to the very first drop in LINE Mode described in (section 13.6). As shown in Fig. 8, the Refill Time for all drops in DROP mode would be $2 + 0.5 = 2.5$ msec. The value of Refill Time in LINE mode is 2 msec except for the very first drop which is 2.5msec.

   Note: this is the value of Refill+ displayed on the LCD screen of the EQ VA30 Jet Valve Controller (see Section 7).

   - **Add XX msec after YY seconds**: is a time value added to the Refill Time after the valve is idled for a defined number of seconds. This additional time is added only to the first drop in both DROP and LINE Mode. As shown in Fig. 8, the Refill Time for the first drop in either DROP or LINE mode after 20 seconds of idle would be $2 + 0.8 = 2.8$ msec.

   Note: this is the value of Refill++ displayed on the LCD screen of the EQ VA30 Jet Valve Controller (see Section 5). In general the value of Refill++ is slightly larger than Refill +.

   Note: Refer Appendix 1 for further description of the First Drop Compensations.

**IMPORTANT:**

Once the names and timing values have been chosen for a recipe be sure to click the **APPLY** button to retain the changes.

### 14.4. Programming Timing Recipes

- A Recipe specifies two timers, Refill Time and Dwell Time, which set the performance of the valve and the size and volume of the jetted drop. The values for Refill Time and Dwell Time should be chosen to optimize the performance and quality of the jet. The values depend on the rheology of the fluid to be dispensed. Refill Time is dependent on the viscosity of the fluid, temperature, and fluid-pressure. It is best to determine the Refill time through application testing. For example, for an UV adhesive with 1,000 cps, a typical refill time might be 1.7 - 2 msec at 15 psi fluid pressure. Too short a refill time could result in a poor quality drop or a missed drop. Too long a refill time could cause accumulation of material on the nozzle tip.

   **Note:** If insufficient refill time is used, the valve will be “starved” and the drop size could be inconsistent. A pattern of large and small drops is usually a sign that the valve needs more time to refill. If this pattern is observed, increase the value of Refill Time until the drops are consistent and stable. Alternatively, you can increase the fluid pressure instead of the refill time if a specific drop rate is desired.
The two values, **Add XX msec** and **Add XX msec after YY seconds** (see Appendix 1), can be added to the Refill Time to adjust the time for the first drop in either the DROP mode or LINE Mode. This is useful with materials that are “shear thinning” and need a little extra time initially after being idle for a period of time. The extra refill time gives the valve a little extra time for the first drop to be ejected.

The Dwell Time controls the time for the material to flow out the nozzle orifice and form a drop. In DROP mode (see section 13.5), the value of Dwell Time is usually not important since its duration is small compared to the motion time of the robot moving from one position to the next. In LINE mode (see section 13.6), however, the Dwell Time is important and sets the drop cycle time. The following formula gives the relationship of drop cycle time, drop spacing, and robot velocity.

\[
\Delta T = \text{Refill Time} + \text{Dwell Time}
\]

\[
\Delta X = \text{Desired Drop Spacing}
\]

\[
V = \left( \frac{\text{Robot Velocity}}{\Delta T} \right) = \frac{\Delta X}{\Delta T} = \frac{\Delta X}{(\text{Fill Time} + \text{Dwell Time})}
\]

The Count is the number of jetted drops desired. The drops are repeated sequentially when it receives a trigger from the robot.

### 14.5. DROP Mode Programming

It is very simple to program the Loctite® system to dispense a drop at a time. The following example illustrates the programming procedure.

- On the Settings Menu (see Section 13.2), select the pull down menu to set the timing recipe for “Recipe #1”
- Set the Count entry to 1 for “Recipe #1”
- Set the Trigger Mode for “Recipe #1” to PULSE.
- Click on “Download Settings” to send the new options to the controller.
- The Robot moves to an XY position.
- The Robot sends a trigger signal on I/O Pin 1 to the controller to jet a drop.
- The Robot moves to another XY position.
- The Robot sends a trigger to the controller to jet a drop, and so on.

The following example illustrates how to dispense multiple drop sizes.

- On the Settings Menu, select the pull down menu to set the timing recipe for “Recipe #1” and “Recipe #2”.
- Set the Count entry in “Recipe #1” to 1 for one drop.
- Set the Count entry in “Recipe #2” to 2 for two drops.
- Set the Trigger Mode for “Recipe #1” and “Recipe #2” to PULSE.
- Click on “Download Settings” to send the new options to the controller.
- The Robot moves to an XY position.
- The Robot sends trigger signal on I/O Pin 1 to jet one drop.
- The Robot then moves to another XY position.
- The Robot sends one trigger signal to I/O Pin 2 to fire 2 drops. (Alternatively, the Robot can issue multiple triggers to I/O Pin 1 to fire multiple drops.)

As you can see, the programming of the Loctite® system is very simple and flexible.
14.6. LINE Mode Programming

The Loctite® controller has a built-in LINE mode to make dispensing lines very simple. The following example illustrates how this can be done.

- Set the Refill Time to 2 msec, and Dwell Time to 3 msec in the Timing Recipes menu (see Section 13.3) for the material you wish to use (The timing is given here for illustration. The exact timing for your fluid and pressure could be different). The ΔT for this example is 5 msec/drop or 100 drops/sec.
- If you want to dispense 60 drops in the LINE, go to the Settings menu (see Section 13.2) and select the 5 msec recipe in the pull down menu, set the Count entry in to 60 and the Trigger Mode to PULSE in “Recipe #3”.
- Click on Download Settings to send the new settings to the controller.
- If your drop spacing ΔX is 0.5 mm, set the velocity of the robot to V = ΔX / ΔT = 0.5mm / 0.005 sec/drop results in a robot velocity of 100 mm/sec since.
- The Robot makes an XY move at 100 mm/s and issues a trigger to I/O Pin 3. The Loctite® controller will jet 60 drops at 0.5mm spacing.
- If you want smaller drops but maintaining the same velocity and ΔX, you can change the Refill Time to 1.7 msec and Dwell Time to 3.3 msec to keep ΔT to be at 5 msec.

Another method to dispense a line is by setting the Trigger mode to LEVEL. The following example illustrates how this can be done.

There is another method to dispense a line if the Robot has the capability to issue triggers during an XY move. The robot will make an XY move and send pulses of trigger to the Loctite® controller at the position where it wants to jet a drop. The following example illustrates the procedure.

- Set the Refill Time to 2 msec, Dwell Time to 2.8 msec, and the number of drops to “1”.
- The robot makes an XY move.
- The robot sends a trigger to the Loctite® controller every 5 msec to form a string of drops.

**CAUTION!**

It is important to not issue a new pulse to the controller until the ΔT cycle is completed. Otherwise, the controller will ignore the trigger if it hasn’t completed its cycle. In the above example, we set the Dwell Time to 2.8 msec to ensure the dispense cycle is completed before the robot issues a new pulse.

14.7. Running a Program from Software

Before running a program for the first time, make sure to check the following:

- Connect all electrical cables to the controller. This includes the jet cable, the I/O cable if remote triggering is used, the RS-232 cable when running from the computer, and the power cable. All connections are unique.
- Turn ON the controller. The heater controller and LCD display should indicate the system is active.
- Run the controller software and make sure the main screen is active, the Controller Status shows: Ready and the Jet button is RED.
Note: When loading the Loctite® software, an initial screen shown below will be presented which reminds you that any previous values that have been set manually in the controller using the front panel LDC screen will be reset. Be sure to note down the values in the controller listed on the front panel LCD screen if you chose “Yes” to overwrite the settings.

NOTE: If this is your first time running the EQ VA30 Jet Valve Controller, do not attempt to use the remote triggering. Run the valve from the main Loctite® software screen.

- In the Settings menu, select the default recipe, SMA 50 – 50Hz, in the Recipe #1. The default timing is (2,8) (0.5, 0.8, 20), the Count is set to 1, and the Trigger Mode is set to Pulse.

- Park the valve over a cup and push the Jet button on the main screen. The Button should turn from RED to BLUE. You should see the material flow through the Feed Tube and out the tip. It might take a while if the material is thick. If the material does not flow out the tip, heat is probably needed. A good starting temperature is 45 C°. Refer to Section 11, Application Notes.

Once material flows, you have successfully primed the valve and are ready to jet actual drops of your material.

15. Loctite® Control Commands

The Loctite® Controller Commands (ACC) is a simple set of commands for controlling the valve and timing values and settings for the recipes. A host computer or external robot is connected to the controller via an RS-232 cable. The host/robot sends ACC commands, in ASCII format, to the controller. This section is intended to serve as a reference for one who is writing a custom program to control the EQ VA30 Jet Valve Controller via ACC commands.

15.1. The RS-23 Interface

The controller is connected to the host computer/external robot via an RS-232 cable. The default settings for the controller are CTS ON, 57600 for Baud Rate, Parity is NONE and Data Length is set to 8BIT. If the host wants to change the default RS-232 settings, refer to Section 13.2 for details.

<table>
<thead>
<tr>
<th>Pin No.</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>RD, Receive Data</td>
</tr>
<tr>
<td>3</td>
<td>TD, Transmit Data</td>
</tr>
<tr>
<td>4</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>GND</td>
</tr>
<tr>
<td>6</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>RTS, Request to Send</td>
</tr>
<tr>
<td>8</td>
<td>CTS, Clear to Send</td>
</tr>
<tr>
<td>9</td>
<td></td>
</tr>
</tbody>
</table>
15.2. Command Format

Each command is identified by two ASCII characters (ST, SL, CT,...) and followed by a series of values. Each value is separated by a COMMA and the last value must be terminated by a SEMICOLON.

- **ST**  Set Recipe Timers
- **SL**  Adjust Refill Time for First Drop
- **CT**  Set Drop Count and Trigger Format
- **SM**  Select Recipe
- **SG**  Start Dispensing
- **SV**  Set Jet Value State
- **SH**  Set Heater Temperature
- **SO**  Turn Heater On/Off
- **HF**  Heater Off timer
- **OS**  Output Jet Status
- **OT**  Output Temperature
- **OV**  Output Version

Example: **CT 0,0,2;** is a valid command. But, **CT 0,0,2** is not valid because the controller is looking for a semicolon before executing this command.

15.3. Recipe Timing commands

**ST # RecipeID, # Refill, #0, #0, #0, #0, #Dwell;**  (Set Recipe Timers)

The **ST** function configures the timing values for the recipe. There are 7 parameters required for this function and they are defined as follows:

- **# RecipeID** Identifies the recipe and it must be between 0 and 5
- **# Refill** Specifies the Refill Time in 0.1 msec units
- **#0, #0, #0, #0** Four reserved timer values and they must all be zeroes
- **# Dwell** Specifies the Dwell Time in 0.1 msec units

Example: The **ST 0,18,0,0,0,0,32;** command will set the first recipe, Recipe #1 to 1.8 msec for Refill Time and 3.2 msec for Dwell Time. The Refill Time plus the Dwell Time set the single drop cycle time to 5msec (1.8 +3.2) resulting in a drop frequency of 200 drops per second.

Example: The **ST 3,50,0,0,0,0,150;** command will set Recipe #4 to 5 msec for Refill Time and 15 msec for Dwell Time. The Refill Time plus the Dwell Time set the single drop cycle time to 20msec (5+15) resulting in a drop frequency of 50 drops per second

**SL # nRecipeID,# Refill+,# Refill++,# DelaySec;**  (Adjust Refill Time for First Dot)

The **SL** command adjusts the Refill Time for the first dot. These values help to control the size and quality of the first dot. There are 4 parameters for this function and they are defined as follows:

- **# nRecipeID** Identifies the recipe and it must be between 0 and 5
- **# Refill+** Sets the timing value in 0.1 msec units to be added to the first dot
- **# Refill++** Sets the timing value in 0.1 msec units to be added to the first dot after the valve is idle for # DelaySec seconds
- **# DelaySec** Sets the valve idle time used by the #Refill++ in seconds.
Example: The **SL 0,2,4,20**; command will set the first recipe, Recipe #1 to 0.2 msec for Refill+ Time, 0.4 msec for Refill++ Time and 20 seconds for idle time. The Refill+ Time (0.2 msec) is added to the Refill Time of Recipe #1 for every drop in DROP mode and added only to the very first drop in LINE mode described in section 13.6. If the valve has been idle for more than 20 seconds, then the Refill++ Time (0.4 msec) is used for first drop adjustment.

**CT #nRecipeID,#TriggerFormat,#nDotCount;** (Set Dot count and Trigger Format)

The CT command set the count value for drops and the format for the trigger input. There are 3 parameters for this function and they are defined as follows:

- **# nRecipeID** Identifies the recipe and it must be between 0 and 5
- **# TriggerFormat** Sets the TriggerFormat to 0 for PULSE and 1 for LEVEL
- **# nDotCount** Sets the number of drops per trigger signal.

Example: The **CT 0,0,2;** command will set the first recipe, Recipe #1 to PULSE trigger and a drop count of 2. This command will cause the valve to dispense 2 drops when it receives a PULSE signal from Recipe #1 Trigger.

Example: The **CT 1,1,5;** command will set the second recipe, Recipe #2 to LEVEL trigger. The number of drops will depend on the duration of the LEVEL signal (low) from Recipe #1 Trigger and the single drop cycle time defined by the **ST** command. The drop count value of 5 is ignored.

### 15.4. Jetting commands

**SM # nRecipeID;** (Select Recipe)

The SM command identifies the recipe that the controller should use when it receives a **SG** (start dispensing) command from the host/robot. This command should be sent before an **SG** command to identify the recipe timers and settings.

- **# nRecipeID** Identifies the recipe and it must be between 0 and 5

Example: The SM 3; command selects Recipe #4

**SG (no values required);** (Start Dispensing)

The **SG** command will cause the controller to activate the valve. You need to use the SM command to identify the recipe for timing values and the number of drops to dispense. The **SG** command must be followed by a semicolon.

Example: Here is a sequence of commands sent to the controller to program Recipe#1 and Recipe#2 before dispensing:

```
ST 0,50,0,0,0,100;
SL 0,2,4,20;
CT 0,1;
ST 1,50,0,0,0,150;
SL 1,2,4,20;
CT 1,0,2;
```

The **CT** command sets one drop to dispense for Recipe#1 and two drops for Recipe#2. When the external host moves to an XY position, it might send the following commands to dispense one drop using the values setup in Recipe#1:

```
SM 0;
SG;
```
The host then moves to another XY position and sends another SG; command to dispense another drop at the new location. It can keep on doing this as long as it is using the values in Recipe#0. If the host decides to dispense 2 drops at the new location, it should send SM 1; command to select Recipe#1 before issuing a SG; command.

**SV # nValveID,# nValveStatus;**  (Set Jet Valve State)

This command allows the host to open or close the valve.
*# nValveID  Set # nValveID to 0 for valve.
# nValveStatus Set # nValveStatus to 0 to open the valve and 1 to close.*

Example: The command **SV 0,1;** will close the valve.

### 15.5.  Heater commands

**SH # nTemperature;**  (Set Heater Temperature)
The SH command allows the host to set the temperature for the Heater Controller in the EQ VA30 Jet Valve Controller.
*# nTemperature  The temperature value is in degrees Celsius.
This value should be less than 75 degrees Celsius.*

**SO # nFlag;**  (Turn heater On/Off)
The SO command allows the host to turn On or Off the heater in the controller.
*# nFlag  Set #nFlag to 1 to turn On the heater and 0 to turn it Off.*

**HF # nMins;**  (Heater Off Timer)
The HF command gives the host the ability to automatically turn Off the heater after a specified valve idle time.
*# nMins  This value defines the idle valve time in minutes.*

Example: The following commands will set the heater temperature to 50 degree Celsius, the idle time to 5 minutes and turn On the heater.

```
SH 50;
HF 5;
SO 1;
```

### 15.6.  Output Commands

**OE**  Output Error
The host can send the OE; command to verify that it is communicating properly with the controller. A return string of **0;** indicates that the command was received without error and **1;** indicates there was an error in the previous command. Once the OS command return string is returned, the error state in the controller is cleared.

**OS**  Output Jet Status
The host can send the OS; command to verify that it is communicating properly with the controller. A return string of **1;** indicates that the valve is closed and **0;** indicates the valve is opened.

**OT**  Output Temperature
The host can send this OT; command to get the present temperature of the valve heater. A return string of **50.5;** indicates the temperature is at 50.5 degree Celsius.
**Output Version**

The host can send this OV; command to identify the controller. A return string of ADV-HV200P_07.31.12 indicates that the host has found the controller.

**Note:** The controller might not be able to respond to the output commands when it is busy dispensing a long series of drops. In this case, the host should try again after a short wait.

### 16. Specifications for Temperature Controller (CN740)

The Temperature Controller (CN740) manual is included with your Loctite® controller shipment. Please refer to it for specific instructions. Listed below are factory set values that should work for the majority of applications. We strongly recommend that you do not modify these values as they are programmed to work with the controller and the valve nozzle plate.

There are three modes: operation, regulation and initial settings.
- To enter regulation mode – press the enter key (the key furthest to the left).
- To enter initial setting mode – press the enter key for more than 3 seconds.
- To enter operation mode – press the enter key twice.

<table>
<thead>
<tr>
<th>CN740 Temperature Process Control</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Address</strong></td>
</tr>
<tr>
<td>4719H</td>
</tr>
<tr>
<td>4702H</td>
</tr>
<tr>
<td>4703H</td>
</tr>
<tr>
<td>4709H</td>
</tr>
<tr>
<td>470AH</td>
</tr>
<tr>
<td>4712H</td>
</tr>
<tr>
<td>4714H</td>
</tr>
<tr>
<td>4716H</td>
</tr>
<tr>
<td>4717H</td>
</tr>
<tr>
<td>4719H</td>
</tr>
<tr>
<td>4706H</td>
</tr>
<tr>
<td>4711H</td>
</tr>
<tr>
<td>4718H</td>
</tr>
<tr>
<td>4715H</td>
</tr>
<tr>
<td>4716H</td>
</tr>
<tr>
<td>471AH</td>
</tr>
<tr>
<td>472AH</td>
</tr>
<tr>
<td>4717H</td>
</tr>
<tr>
<td>471AH</td>
</tr>
<tr>
<td>4717H</td>
</tr>
<tr>
<td>4717H</td>
</tr>
<tr>
<td>4717H</td>
</tr>
<tr>
<td>4717H</td>
</tr>
</tbody>
</table>
**17. Digital Pressure Gauges**

**KEYENCE**

*Two-color Digital Display Pressure Sensor AP-30 Series*

*Instruction Manual*

## SPECIFICATIONS

<table>
<thead>
<tr>
<th>Type</th>
<th>Negative pressure</th>
<th>Positive pressure</th>
<th>Compound pressure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model ¹</td>
<td>AP-31K(P)</td>
<td>AP-32K(P)</td>
<td>AP-33K(P)</td>
</tr>
<tr>
<td>Rated pressure</td>
<td>0 to -29.9 inchHg (0 to -101.3 kPa)</td>
<td>0 to 14.50 Psi (0 to 100 kPa)</td>
<td>0 to 145.0 Psi (0 to 1,000 MPa)</td>
</tr>
<tr>
<td>Proof pressure</td>
<td>72.5 Psi (490 kPa)</td>
<td>72.5 Psi (490 kPa)</td>
<td>217.5 Psi (1.47 MPa)</td>
</tr>
<tr>
<td>Pressure type</td>
<td>Gauge pressure</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fluid types</td>
<td>Air or noncorrosive gases</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Display</td>
<td>3 1/2-digit, 2-color, 7-segment LED (Character height: 11 mm)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Display resolution</td>
<td>0.1 kPa, 1 mmHg, 0.1 inchHg, 0.001 bar</td>
<td>0.1 kPa, 0.001 kgf/cm², 0.02 Psi, 0.001 bar</td>
<td>0.001 MPa, 0.01 kgf/cm², 0.2 Psi, 0.01 bar</td>
</tr>
<tr>
<td>Detectable pressure range</td>
<td>-15% to +110% of F.S.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Repeatability</td>
<td>±0.2% of F.S. (5 ms or more)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Response time (chattering prevention function)</td>
<td>2.5/5/100/500 ms (selectable)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Control output</td>
<td>NPN/PNP open-collector: 100 mA max. (40 V max.) (PNP: 30 V max.), Residual voltage: 1 V max. 2-output (N.O./N.C. selectable)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Analog output</td>
<td>1 to 5 V (Load impedance: 47 kΩ min.)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Temperature fluctuation for analog output</td>
<td>±2% max. of F.S. of detecting pressure at 25°C (77°F) within 0 to 50°C (32 to 122°F)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Temperature fluctuation for display</td>
<td>±1% max. of F.S. of detecting pressure at 25°C (77°F) within 0 to 50°C (32 to 122°F)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Current consumption</td>
<td>50 mA (at 24 V), 90 mA (at 12 V)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Power supply</td>
<td>12 to 24 VDC±10%, Ripple (p-p): 10% max.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ambient temperature</td>
<td>0 to 50°C (32 to 122°F), No freezing</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Relative humidity</td>
<td>35 to 85%, No condensation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vibration</td>
<td>10 to 55 Hz, 1.5 mm double amplitude in X, Y, and Z directions, 2 hours respectively</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Material</td>
<td>Front housing: Polyamide, Front panel sheet: PET, Rear housing: Polysulfone, Pressure port: Die-cast zinc, Cable: Oil-proof cabletyre cable</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Weight (including 2 m cable)</td>
<td>Approx. 120 g</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

A "P" following the model number indicates PNP-output type.
PART NAMES AND FUNCTIONS

AUTO key
In auto-tuning mode, use this key to detect pressure. In measurement mode, press this key for 2 seconds or more to adjust the zero-point.

SET key
Use this key to display or change preset values.

Output indicator 1
(Red LED)

Output indicator 2
(Green LED)

UP/DOWN key
Use these keys to set output modes, or to change preset values or units.

Display unit label
The AP-30 series enables you to select the display units for pressure. Attach the included display unit label for the desired units at the position in the figure.

Housing

Bolt

Rear metal casing
(Die-cast zinc)
CONNECTIONS AND INPUT/OUTPUT CIRCUIT

■ Connections
- Drive current load
  NPN output
  ![NPN output diagram]
  PNP output
  ![PNP output diagram]

■ Input/output circuit
- Output circuit
  NPN output
  ![NPN output circuit diagram]
  PNP output
  ![PNP output circuit diagram]
- Analog output circuit
  ![Analog output circuit diagram]
OPERATION MODE SELECTION

■ Auto-tuning mode (F-1)

Using the AUTO key, detect the upper limit value (A) and the lower limit value (b). The detection level (C) is automatically set at the midpoint between the two values. (You can finely adjust the preset value C within the range between A and b.)

Control output 1: The sensor turns on when the pressure exceeds the preset value C.
Control output 2: The sensor turns on when the pressure goes outside the stability levels.

* The stability levels are automatically set as shown in the following calculations.

\[
SH = \frac{(A + C)}{2} \\
SL = \frac{(C + b)}{2}
\]

■ Hysteresis mode (F-2)

Set desired detection level (H) and hysteresis (h) for the detection.

Control output 1: The sensor turns on when the pressure exceeds the preset value H. When the pressure falls by the preset value h, the sensor turns off.
Control output 2: The sensor turns on when the pressure goes outside the hysteresis width (H - h).

h: Hysteresis width of OUT1
* When h is set to a value close to 0, if pressure fluctuates around the detection point, OUT1 will chatter.
2-independent mode (F-3)

Set two desired detection points (A and B).

Control output 1: The sensor turns on when the pressure exceeds the preset value A.

Control output 2: The sensor turns on when the pressure exceeds the preset value b.

Window mode (F-4)

Set desired upper limit value (H) and lower limit value (L).

Control output 1: The sensor turns off when the pressure goes outside of the range between the upper limit value (H) and lower limit value (L).

Control output 2: The sensor turns off when the pressure goes outside of the stability levels.

* The stability levels are automatically set as shown in the following calculations.

\[
SH = H - \frac{(H - L)}{4}
\]

\[
SL = L + \frac{(H - L)}{4}
\]

Note 1: The above description shows the operation of control outputs 1 and 2 when the output selector switch is set to N.O. When the output selector switch is set to N.C., the operation of control outputs 1 and 2 is inverted.

Note 2: Except for OUT1 in hysteresis mode, each control output includes an internal hysteresis of 0.5% of F.S.
**ADJUSTMENT**

**Unit Setting**
Determine the desired units.
In measurement mode, press for at least 3 seconds. "- - - -" appears first, and then the current units are displayed. Use or to select the desired units. Pressing completes the unit setting procedure and enters operation mode selection.

<table>
<thead>
<tr>
<th>Unit</th>
<th>AP-31/32/34: mmHg, kPa/ft²</th>
<th>AP-31/32/34: kPa, MPa</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inch</td>
<td>AP-31/32/34: mmHg, kPa/ft²</td>
<td>AP-31/32/33/34: bar</td>
</tr>
</tbody>
</table>

* When the units are changed, the preset values are automatically converted to appropriate values for the updated units.

**Operation Mode**
Determine the desired operation mode.
(Refer to "OPERATION MODE SELECTION" on page 2.)
The current operation mode is displayed. Use or to select the operation mode. Pressing completes the operation mode setting procedure and enters N.O./N.C. selection.

<table>
<thead>
<tr>
<th>Mode</th>
<th>Auto-tuning mode</th>
<th>Hysteresis mode</th>
<th>2-independent output mode</th>
<th>Window mode</th>
</tr>
</thead>
<tbody>
<tr>
<td>F-1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>F-2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>F-3</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>F-4</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**N.O./N.C. Selection**
Select N.O. (normally open) or N.C. (normally closed).
The current selection of "nO" (normally open) or "nC" (normally closed) is displayed. Use or to select the desired mode. Pressing completes the N.O./N.C. selection procedure and enters the chattering prevention setting.

**Chattering Prevention**
Determine the desired response time.
The current response time is displayed. Use or to select the response time. Pressing completes the setting procedure and enters the display color selection.

<table>
<thead>
<tr>
<th>Time</th>
<th>25</th>
<th>2.5 ms</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>5</td>
<td>5 ms</td>
</tr>
<tr>
<td></td>
<td>100</td>
<td>100 ms</td>
</tr>
<tr>
<td></td>
<td>500</td>
<td>500 ms</td>
</tr>
</tbody>
</table>

**Display Color Selection**
Determine the desired LED color for numerical value display.
The current color is displayed. Use or to select the color. Pressing completes the setting procedure and returns to the measurement mode.

- L: Red LED only
- L: Red/green LED

* The setting is saved in the EEPROM.

**Zero-point adjustment**
At normal atmospheric pressure (1 atm.), press for at least 2 seconds in measurement mode. The display changes to "- - - -", then to "0". The zero adjustment function can be used when the pressure is within ±5% of F.S.

**Preset Value Input Mode**
Determine the preset values.

- Auto-tuning mode (F-1)
  1. In measurement mode with the current measured value displayed, press . The AP-30 enters the preset value input mode.
  2. "A" and the current preset value flash alternately.
  3. Position the target at the desired upper (lower) limit.
  4. Press to register the value. The updated value is displayed for 1 second.
  5. "b" and the current preset value flash alternately.
  6. Position the target at the desired lower (upper) limit.
  7. Press to register the value. The updated value is displayed for 1 second.
  8. "C" and the calculated preset value C flash alternately. (You can change the C value to any value between A and B using or .)
  9. Press to register the C value. The setting procedure is completed and the unit returns to measurement mode.

- To confirm the preset value, press repeatedly.

- Example of auto-tuning mode setting: Confirmation of work piece pick-up.
Set the upper limit (A) to the position where the work piece is taken. Set the lower limit (B) to the position where the nozzle becomes open after releasing the work piece. Press to register the upper and lower limit values. The C value is automatically set to the midpoint between the upper and lower limit values.

**Hysteresis Mode (F-2), 2-Independent Output Mode (F-3), Window Mode (F-4)**

1. In measurement mode with the current measured value displayed, press . The AP-30 enters the preset value input mode.
2. "H-" and the current preset value flash alternately.
3. Use or to change the value to the desired value. Press to register the updated H value.
4. "H+" and the current preset value flash alternately.
5. Use or to change the value to the desired value. Press to register the updated H value.
6. Press to complete the setting procedure and return to measurement mode.

* To confirm the preset value, press repeatedly.

Note 1: In hysteresis mode, (H - F.S.) cannot be set to a value greater than H.
Note 2: In window mode, (L + 1% of F.S.) cannot be set to a value greater than H.

**Zero-point adjustment**
At normal atmospheric pressure (1 atm.), press for at least 2 seconds in measurement mode. The display changes to "- - - -", then to "0". The zero adjustment function can be used when the pressure is within ±5% of F.S.

**Preset Value Input Mode**
Determine the preset values.

- Auto-tuning mode (F-1)
  1. In measurement mode with the current measured value displayed, press . The AP-30 enters the preset value input mode.
  2. "A" and the current preset value flash alternately.
  3. Position the target at the desired upper (lower) limit.
  4. Press to register the value. The updated value is displayed for 1 second.
  5. "b" and the current preset value flash alternately.
  6. Position the target at the desired lower (upper) limit.
  7. Press to register the value. The updated value is displayed for 1 second.
  8. "C" and the calculated preset value C flash alternately. (You can change the C value to any value between A and B using or .)
  9. Press to register the C value. The setting procedure is completed and the unit returns to measurement mode.

- To confirm the preset value, press repeatedly.

- Example of auto-tuning mode setting: Confirmation of work piece pick-up.
Set the upper limit (A) to the position where the work piece is taken. Set the lower limit (B) to the position where the nozzle becomes open after releasing the work piece. Press to register the upper and lower limit values. The C value is automatically set to the midpoint between the upper and lower limit values.

**Hysteresis Mode (F-2), 2-Independent Output Mode (F-3), Window Mode (F-4)**

1. In measurement mode with the current measured value displayed, press . The AP-30 enters the preset value input mode.
2. "H-" and the current preset value flash alternately.
3. Use or to change the value to the desired value. Press to register the updated H value.
4. "H+" and the current preset value flash alternately.
5. Use or to change the value to the desired value. Press to register the updated H value.
6. Press to complete the setting procedure and return to measurement mode.

* To confirm the preset value, press repeatedly.

Note 1: In hysteresis mode, (H - F.S.) cannot be set to a value greater than H.
Note 2: In window mode, (L + 1% of F.S.) cannot be set to a value greater than H.

Note 1: When the operation mode is changed, check the preset values in the printed value input mode.
Note 2: Perform the zero-shift adjustment periodically.
Note 3: The initial output voltage may fluctuate by ±1.0% immediately after the power is turned on. To measure minute differences in pressure, let the sensor warm up for approximately 15 to 30 minutes.
OTHER FUNCTIONS AND ERROR INDICATION

■ Key protection function

The key protection function is used to lock the front panel key in order to prevent preset values from being accidentally changed.

To enable the key protection function, hold down \( \text{[A]} \) and press \( \text{[A]} \). "Lac" flashes for 2 seconds and the keys are locked.

To disable the key protection function, again hold down \( \text{[A]} \) and press \( \text{[A]} \). "unL" flashes for 2 seconds and the keys are unlocked.

Using the EEPROM, the AP-30 series can retain the preset values even if the power is turned off.

■ Display color selection

You can set the color of the LED display either to the two-color mode which displays the numerical value in green or red according to OUT1, or to the single color mode which always shows the value in red. The two-color display allows you to check the output condition at a glance. (Refer to "ADJUSTMENT" on page 3 for the setting procedure.)

In two-color mode (Regardless of N.O./N.C. selection)
- When OUT1 is turned on: Red
- When OUT1 is turned off: Green

■ Peak-hold/bottom-hold display function

The AP-30 series internally updates the peak-hold and bottom-hold values at all times.

- To display hold values
  - While \( \text{[A]} \) is held down in measurement mode, the peak-hold value is displayed.
  - While \( \text{[B]} \) is held down in measurement mode, the bottom-hold value is displayed.

- To reset the peak-hold and bottom-hold values
  - Hold down \( \text{[A]} \) and press \( \text{[B]} \) in measurement mode.

- The peak-hold and bottom-hold values are also reset using the following procedure.
  - Turn the power off.
  - Press \( \text{[B]} \) for 3 seconds or more and change any settings.

Note: The hold values cannot be displayed when the front panel keys are locked with the key protection function. Disable the function before displaying the hold values.

■ Analog output function

The voltage value according to the pressure value is output.

<table>
<thead>
<tr>
<th>Model</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>AP-31</td>
<td>0 to -29.9 in. Hg (0 to -101.3 kPa)</td>
</tr>
<tr>
<td>AP-32</td>
<td>0 to 14.5 psi (0 to +100.0 kPa)</td>
</tr>
<tr>
<td>AP-33</td>
<td>0 to 145.0 psi (0 to +1,000 MPa)</td>
</tr>
<tr>
<td>AP-34</td>
<td>+29.9 to -29.9 in. Hg (+101.3 to -101.3 kPa)</td>
</tr>
</tbody>
</table>

■ Error indications and remedies

<table>
<thead>
<tr>
<th>Error indication</th>
<th>Problem</th>
<th>Remedy</th>
</tr>
</thead>
<tbody>
<tr>
<td>( E )</td>
<td>Zero-point adjustment was executed at a pressure of ( \pm 5% ) or more of F.S.</td>
<td>Perform zero-point adjustment at normal atmospheric pressure.</td>
</tr>
<tr>
<td>( Ec )</td>
<td>Overcurrent through OUT1 or 2</td>
<td>Turn power off and adjust the load so that the current is within the rated range.</td>
</tr>
<tr>
<td>-FFF, FFF</td>
<td>Applied pressure was outside of the display range.</td>
<td>Adjust the pressure to within the rated range.</td>
</tr>
</tbody>
</table>

■ N.O./N.C. selection

The N.O. or N.C. output can be selected according to the device's control method. When the output status is changed, the color of the numerical value display LED is inverted.

■ Chattering prevention function

The chattering prevention function is used to prevent outputs from chattering by changing the response time. The response time can be selected from 4 settings. When the detection (non-detection) state continues for more than a preset response time, the output is produced.
18. Appendix 1: First Drop Compensation

Background:
Many viscous fluids are thixotropic and the viscosity decreases with motion. This is often referred to as shear-thinning. When dispensing a thixotropic fluid, the very first drop ejected can often be smaller than subsequent drops if the valve has been idle for some time. The parameters Refill + and Refill ++ can be used to compensate for small first drops.

Traditional Solutions:
Traditionally, operators often dispense a few “wasted drops” in a blank area of the substrate to get the dispensing material into a shear-thinning condition. This technique is a good solution because it gets rid of the first drop problem all together. However, it wastes time and fluid.

Compensations:
The Loctite® controller offers two additional jetting parameters to help alleviate this problem. They are:

- First Drop Compensation T+
- Extended Drop Compensation T++

Elapse Time is defined as the idle time of the valve since the last dispense.

Extended Time is the time entered in the Recipes Menu/Adjust Refill Time for first drop “msec after YY seconds” (see Section 3.3)

If Elapse Time < Extended Timeout, then Refill Time = Refill + T+
If Elapse Time > Extended Timeout, then Refill Time = Refill + T++

Examples:
For a time cure material, the fluid could be slightly thickening if it sits idle for a long time especially if the fluid is being actively heated. Let’s say we set the Extended Timeout to 20 seconds. The first drop refill time will equal (Refill + T*). The value of T* depends on how long the valve has been idle.

If Elapse Time < 20 sec (Extended Timeout), then T* = T+
If Elapse Time >= 20 sec (Extended Timeout), then T* = T++

The Refill Time for the first drop of all the lines = Refill + T++. Subsequent drops will have a Refill Time without any compensation if multiple drops are specified.
When dispensing individual drops with an elapsed time less than 20 seconds, the compensation is always applied. The Refill Time for individual drops = Refill + T+.

PULSE mode:

- In this mode, the controller produces “n” drops when it receives a trigger signal, where “n” is the number of drops.
- The refill time for the first dot = Refill + T+
- The refill time for all subsequent dots = Refill (no added first drop compensation)
- If the number of drops is set to 1, the refill time will always be Refill + T+ because there is no subsequent dots.

Example of when number of drops is 1:

- In the timing diagram below, T* = T++, therefore each drop = Refill + T++
Example of when number of drops is 3.

- In the timing diagram below, $T^* = T_+$, therefore the first drop = Refill + $T_+$. 
- The refill time for all other drops = Refill (no first drop compensations added)
LEVEL mode:

- In this mode, the controller produces drops as long as the Trigger signal is high.
- The refill time for the first dot = Refill + T
- The refill time for all other dots = Refill

19. Appendix 2: Cleaning the EQ VA30 Jet Valve

1. Cleaning the Exterior of the Valve

To clean the exterior of the valve, please use a soft cotton or cellulose cloth. If extremely dirty, a small amount of alcohol can be used.

CAUTION!
WARNING: Make sure you have proper ventilation. Wear appropriate eye and skin protection as instructed by the solvent manufacturer. Move the nozzle in a position so there is minimal misting of the solvent during flushing.

CAUTION!
WARNING: Do not use a dripping wet cloth and do not pour solvents, alcohol, water or other liquids directly on the valve. As well, do not submerge the valve in the cleaning agent. Otherwise the valve can be damaged.

2. Cleaning the Interior of the Valve

IMPORTANT:
It is important the nozzle plate and diaphragm are clean, free of debris before installing onto the valve. If the nozzle plate is not clean, it could affect the dispensing quality, or in the worst case, could plug the nozzle orifice.
The Loctite® EQ VA30 Jet Valve is a very precise valve for dispensing very precise and minute amounts of fluid. The operation can become clogged by the smallest contaminates or become blocked which will adversely affect dispensing results.

Contamination of the jet can manifest itself, for example, through the following symptoms:

- Unclean or uneven dispensing or the drops become irregular or vary in size
- Residual flow or drooling out the tip when the valve is in the closed position
- Interrupted dispensing where fluid no longer is dispensed
- Splatter or satellites are present

The nozzle plate can be purged, rinsed with the recommended solvent for the fluid and cleaned with an ultrasonic cleaner. Normally only 5 minutes are required to clean the nozzle plate in the ultrasonic cleaner. If after 5 minutes the nozzle plate is still not clean, repeat a second time. Do not submerge the nozzle plate for extended periods of time.

**CAUTION!**

**IMPORTANT:** Never submerge the valve diaphragm in solvents as they might be damaged. Diaphragms can be cleaned successfully with a small amount of solvent and a soft brush and cotton swab. Do not submerge the diaphragm into the ultrasonic cleaner because it will deteriorate the diaphragm and shorten its life.

1. Turn off the **Air** switch to the “0” position.

**CAUTION!**

It is important to first **turn off the Air switch**. If not, the fluid from the syringe will make a mess if you dismount the feed tube under pressure.

2. Remove the Receiver Head.

3. Remove the Feed tube from the Nozzle Plate

4. Remove the syringe from the valve.
5. Install an empty syringe with a feed tube onto the Fluid Barb of the Nozzle Plate.

6. Fill the syringe with about 3 cc of mild solvent compatible with your fluid material.
   - For example, use isopropyl alcohol to flush most underfill material, flushes, etc.
   - Do not use alcohol to flush SMA (Surface Mount Adhesive) for the alcohol will solidify the epoxy into small particles that will plug the orifice.

7. Install the Receiver Head onto the syringe.

8. Set to Recipe #6. Recipe 6 is pre-programmed to have 10.0 Refill and 10.0 Dwell and 250 Drops.

9. Turn on the Air switch to the “1” position.

10. Place a paper towel or aluminum-foil dish under the Nozzle.

**CAUTION!**

Make sure you have proper ventilation. Wear appropriate eye and skin protection as instructed by the solvent manufacturer. Move the nozzle close to the paper so there is minimal misting of the solvent during flushing.
11. Press the **Trigger** button to run Recipe #6 to flush the Jet.

- Repeat this process until the liquid that comes out of the nozzle is clear and clean. It normally requires about 5 to 6 flushes of 250 drops.
- Continue to press the Trigger button until all of the 3cc solvent is flushed.
- If there is too much solvent in the syringe, you can **OPEN** the Jet to let out the remaining solvent.

**Note:** it is easier to work with an empty syringe – Let the remaining solvent totally empty to manage the solvent in the cleanest way.

12. Turn off the **Air** switch to the “0” position.

13. Remove the flushing syringe.

14. Remove the Nozzle Plate with the 3 mm Hex Key.

15. Remove the Diaphragm from the Heater Block.

16. Inspect the Diaphragm and Nozzle Plate if they require further cleaning. Normally, the flushing process gets them 90% cleaned.

17. Hand clean the Diaphragm with mild solvent and a brush.

18. If necessary, submerge the Nozzle Plate into an ultra-sonic cleaner for 10 minutes to be thoroughly cleaned. The Nozzle Plate can be cleaned with a stronger solvent than for the Diaphragm.

### 20. Appendix 3: Startup Quick Reference

1. Inspect the Nozzle plate for cleanliness.

   It is important to inspect the nozzle plate for debris before mounting it onto the valve. If the nozzle plate is not clean, it could affect the dispensing quality, or in the worst case, could plug the nozzle orifice. Refer to **Appendix 2** for cleaning the nozzle.

   ![Example of a clean nozzle.](image1) ![Example of a dirty nozzle.](image2)
2. Switch the Air to the “0” position. This turns off the air pressure.

3. Turn on the Controller by setting the Power switch to the “1” position.

4. Set the Jet Pressure to the value dictated by your application.
   - Consult the appendix for Jetting Parameters if unclear.
   - The default pressure unit is MPa (1 MPa = 145 psi.)
   - First, turn the knob down to 0.100 below the set value.
   - Then, turn up slowly until it reaches the desired value.
   - Adjust to +/- 0.005 MPa is acceptable.
   - If you overshoot the value, back down below the set value and always “turn up to” the set value.

5. Press the RIGHT key and move the blinking cursor to the Jet position.

6. Toggle the UP key to OPEN.

7. Align the Diaphragm as shown in the diagrams. Gently press the diaphragm into the rectangular grooves until it is firmly in place.
8. Align the Nozzle Plate to the alignment pins on the Heater Block, with the Fluid Barb facing the front.

9. Tighten the two embedded screws with a 3 mm Hex Key until finger tight. (Add ¼ turn once you feel the screws touch the bottom.) Do not overtighten, it is possible to strip the screws.

10. **CLOSE** the Jet before you install the Fluid Syringe.

11. Insert the Feed tube into the syringe and insert a syringe spacer ring if the syringe is smaller than 30cc. Slip the feed tube on the barb end of the nozzle plate and install the receiver head.
12. Setting Dispensing Parameters

1. Refer to Operation Instructions in the manual for detailed description of how to set the parameters. You can also refer to Appendix 3 for a quick reference of the values of the Dispensing Parameters for various fluids.

2. Turn on the heater and wait 10 minutes for the temperature of the nozzle to be stable.
   
   You can turn on the heater from the software, or from the front panel.
   - Refer to the Operation Instructions Manual on how to turn on the heater from the software.
   - Or follow the following procedure to turn on the heater from the front panel.

   1. Press the button to show the status.
      
      "Stop" = heater is on.
      "run" = heater is off.

   2. Press the button to turn on the heater.

   3. Press the button to accept the change.

   Note: the software does not automatically communicate the settings to the controller. If you set the temperature in the software “Download” the recipe to the controller.

3. **CLOSE** the **Jet** before turning on the **Air** switch.

4. Turn on the **Air** switch to the “1” position.

5. **OPEN** the **Jet** to let the fluid in the syringe to flow into the Nozzle Plate. This process is called "to Prime" the Jet.
13. Dispense Sample Dots

1. Set the Recipe # to what you wish to dispense.

![Recipe Display](image)

Note: when running a recipe from the software, this is ignored. When pressing the “Trigger Button” the recipe on the display is used.

2. Press the Trigger Button to run the Recipe. Place a substrate under the nozzle to observe the quality of the drops that came out. Repeat this 4 to 5 times to ensure the valve is properly primed.

![Trigger Button](image)

3. Observe the Nozzle Tip if it is clean. The tip should be clean without any fluid clinging on the edge of the tip. If it is not clean, the temperature may not have been stable, or the jetting parameters were set incorrectly. Refer to the Trouble Shooting section if this problem persists.

21. Accessories and Spare Parts for Jet Valve

<table>
<thead>
<tr>
<th>Description</th>
<th>Item Number</th>
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<tbody>
<tr>
<td>Nozzle Plate With Ceramic Insert 75 Micron</td>
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<td>Nozzle Plate With Ceramic Insert 125 Micron</td>
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<td>Repair Kit for Pressure Actuator</td>
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<tr>
<td>Heater Repair Kit</td>
<td>1874363</td>
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<tr>
<td>Syringe Air Line Adapter Kit 2 Pack</td>
<td>88678 (97245)</td>
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22. Warranty

Henkel expressly warrants that all products referred to in this Instruction Manual for the EQ VA30 Jet Valve System (hereafter called “Products”) shall be free from defects in materials and workmanship. Liability for Henkel shall be limited, as its option, to replacing those Products which are shown to be defective in either materials or workmanship or to credit the purchaser the amount of the purchase price thereof (plus freight and insurance charges paid therefor by the user). The purchaser’s sole and exclusive remedy for breach of warranty shall be such replacement or credit.

A claim of defect in materials or workmanship in any Products shall be allowed only when it is submitted in writing within one month after discovery of the defect or after the time the defect should reasonably have been discovered and in any event, within (12) months after the delivery of the Products to the purchaser. This warranty does not apply to perishable items, such as (fuses, filters, lights, etc.). No such claim shall be allowed in respect of products which have been neglected or improperly stored, transported, handled, installed, connected, operated, used or maintained. In the event of unauthorized modification of the Products including, where products, parts or attachments for use in connection with the Products are available from Henkel, the use of products, parts or attachments which are not manufactured by Henkel, no claim shall be allowed.

No Products shall be returned to Henkel for any reason without prior written approval from Henkel. Products shall be returned freight prepaid, in accordance with instructions from Henkel.

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# 23. Declaration of Conformity

<table>
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<th>Declaration of Conformity</th>
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<tr>
<td><strong>The Manufacturer</strong></td>
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<tr>
<td>according to the EC regulations</td>
</tr>
<tr>
<td>Henkel AG &amp; Co. KGaA</td>
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</tr>
<tr>
<td>Gutenbergstr. 3</td>
</tr>
<tr>
<td>D-85748 Garching bei München</td>
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declares that the unit designated in the following is, as a result of its design and construction, in accordance with the European regulations, harmonized standards and national standards listed below.

<table>
<thead>
<tr>
<th>Designation of the unit</th>
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<tbody>
<tr>
<td>VA 30 Jet Controller</td>
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<td>EC Directive of RoHS 2002/95/EG</td>
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<td>EC Directive of Low Voltage 2006/95/EG</td>
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<td>DIN EN 61000-4-4:2013-04; DIN EN 61000-4-5:2007-06;</td>
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Garching, 10.1.2014

(Dr. W. Fleischmann)
Site Manager Munich

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