

Introduction

You have selected a reliable, high quality PicoDot dispensing system from EFD, the world leader in fluid dispensing. The PicoDot dispensing system was designed specifically for industrial dispensing, and will provide you with years of trouble-free, productive service.

This User's Guide will help you maximize the usefulness of your PicoDot dispensing system.

Please spend a few minutes to become familiar with the controls and features. Follow our recommended testing procedures. Review the helpful information we have included, which is based on more than 30 years of industrial dispensing experience.

Most questions you will have are answered in this guide. However, if you need assistance, please do not hesitate to contact EFD or your authorized EFD distributor.

In Asia, call +86 (21) 5854 2345.

In Europe, call +44 (0) 1582 666334.

In the USA, call 800-556-3484 between 8:30 a.m. and 5:30 p.m. Eastern time.

In all other areas, call your authorized EFD distributor or +1-401-434-1680.

The EFD Pledge

Thank You!

You have just purchased the world's finest dispensing equipment.

I want you to know that all of us at EFD value your business and will do everything in our power to make you a satisfied customer.

If at any time you are not fully satisfied with our equipment or the support provided by your EFD Product Application Specialist, please contact me personally at 800-556-3484 (US), 401-434-1680 (outside US), or plambert@efd-inc.com.

I guarantee that we will resolve any problems to your satisfaction.

Thanks again for choosing EFD.

Peter Lambert

Peter Lambert, President

Contents

Safety Instructions	4-5
1 PicoDot Needle Valves	6
1.1 Needle Valve Operation	7
2 Setup Schematic	8
2.1 Specifications—PicoDot Needle Valve	9
2.2 Specifications—PicoDot Needle Valve Driver	10
2.3 PicoDot Needle Valve Driver Interfaces	11
2.3.1 Power Interface	11
2.3.2 Valve Interface	11
2.3.3 5V Bat. Connection	12
2.3.4 Input/Output	12
2.4. Connecting the PicoDot Needle Valve and Driver	13
2.5. Sample Programming to Create a Signal with a PLC	14
3 Cleaning	15
3.1 Removing Bubbles from the Needle	15
3.2 Rinsing the Fluid Channel	16
3.3 Cleaning the Nozzle	17
3.4 Testing for Leaks	18
Appendices	19-22
A-1 PicoDot Needle Valve Drawing	19
A-2 Declaration of Conformity – PicoDot Needle Valve	20
A-3 PicoDot Needle Valve Driver Drawing	21
A-4 Declaration of Conformity – PicoDot Needle Valve Driver	22

Safety Instructions

WARNING

Never open the valve driver power supply.
Failure to comply could result in death or serious injury.

CAUTION

Never activate the valve without fluid. Activating the valve without fluid could damage the nozzle plate and cause the valve to leak.

CAUTION

Never attempt to unscrew the cord set from the valve.
Doing so could damage the electrical contacts and make the valve inoperable.

CAUTION

Each valve and its associated nozzle plate are precision aligned at the factory and delivered as a matched assembly with identical serial numbers on the valve and nozzle plate. Be careful not to accidentally interchange valves and nozzles when cleaning or performing maintenance.

Due to the arrangement of the piezoelectric actuator, PicoDot needle valves will not close completely when power to the valve driver is shut off. In case of power outage, a rechargeable battery in the valve driver will keep the valve closed for up to 20 minutes. After this time fluid might leak. To avoid contamination of parts or the production machine, fluid pressure should be released if the voltage drops at the valve driver power supply. Fluid pressure should also be released if the system is shut down between shifts or overnight.

Before using the PicoDot valve, check to see if fluid flows out of the valve when the valve driver is turned off and no fluid pressure is being applied. If this occurs, the fluid reservoir should be positioned lower than the valve.

The valve cannot be closed correctly if the valve or valve driver is damaged. This will cause fluid to leak. To avoid contamination, you should constantly monitor the status of the valve driver via the interface. If a fault is detected, fluid pressure should be turned off immediately.

The PicoDot needle valve can only be operated with the PicoDot needle valve driver. In addition, the valve has to be operated within the parameters specified by EFD.

The PicoDot needle valve should only be connected with the cable supplied by EFD.

The valve driver must be turned off before installing or removing the valve cable. Switching off the valve driver will open the valve immediately. Release fluid pressure before turning off the valve driver.

Ensure that all components are turned off and depressurized before attempting to connect them. This also applies to maintenance and repairs.

Clean the valve exterior with a soft, lint-free cloth. If extremely dirty, the cloth may be slightly moistened with alcohol.

Connection of equipment not supplied by EFD is at the user's risk.

Repairs and modifications may only be made by EFD.

NOTE: Equipment owners are responsible for ensuring that users receive safety training appropriate to their job function as directed by governing regulations and best industry practices; are familiar with the equipment owner's safety and accident prevention policies and procedures; and receive equipment- and task-specific training from another qualified individual.

1 PicoDot Needle Valves

PicoDot needle valves may only be used with PicoDot needle valve drivers and extension cables.

PicoDot needle valves are capable of dispensing exact amounts of a wide range of fluids with different viscosities.

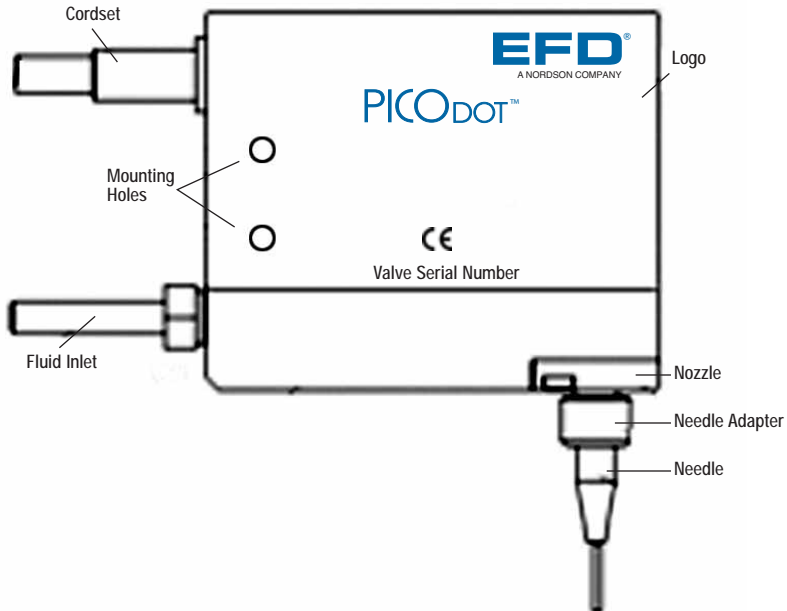
The following dispensing modes are possible:

1. Contact dispensing of dots or beads of fluid with a dispensing needle.
2. Automated contact dispensing and spreading of fluids with a dispensing needle.

There are no technical limitations regarding installation position, making the fixturing of PicoDot valves easy.

⚠ ATTENTION

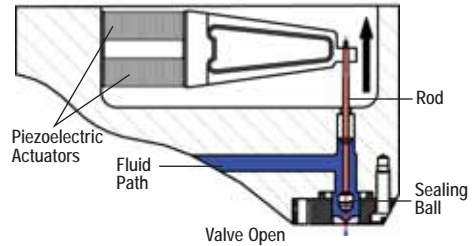
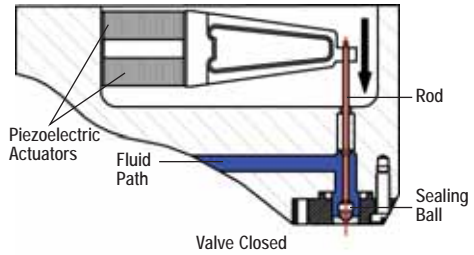
Do not attempt to dispense fluids that could damage the housing material (1.4305/303 series stainless steel) or sealing element (perfluoroelastomer). Do not use cyanoacrylates, anaerobic methacrylates or pre-mixed 2-part adhesives with a short pot life. They can cure in the valve and cause serious damage.



1.1 Needle Valve Operation

The PicoDot needle valve is driven by two piezoelectric actuators. Their movement is imparted to a rod, which is then lifted or lowered. A sealing ball made of wear-resistant ceramic is fixed to the lower end of the rod. The nozzle is closed by a sealing ball. When the sealing ball is lifted, fluid can flow from the valve.

Due to the maintenance-free and extremely fast piezoelectric actuator it is possible to jet with a frequency of up to 150 Hz in continuous operation, and up to 1000 Hz for short periods. However, the cycle rate should never exceed 150 cycles per second.



For PicoDot needle valves, the minimum dosage time (one open/close cycle) at maximum stroke is approximately 0.500 milliseconds. Depending on the fluid, the fast piezoelectric actuator can produce deposits as small as 2nl. The high resolution of the PicoDot valve controller (0.01 ms) makes it possible to adjust the deposit size very precisely.

Due to the arrangement of the piezoelectric actuators and the wear-resistant ceramic valve seat, the life of the actuator and the valve seat is extremely high. The valve seat should be checked after 10 million cycles. First check-up of the piezoelectric actuator should be carried out after 100 million to 350 million cycles, depending on jetting frequency and the temperatures used.

The signal for the piezoelectric actuators is generated by an amplifier located in the PicoDot jet valve driver. An interface in the valve driver permits the use of external signals to change the jetting parameters. This interface can be used with a PicoDot valve controller or a PLC (programmable logic controller).

Fluid can be delivered to the valve by pneumatic pressure or a feed pump.

⚠ CAUTION

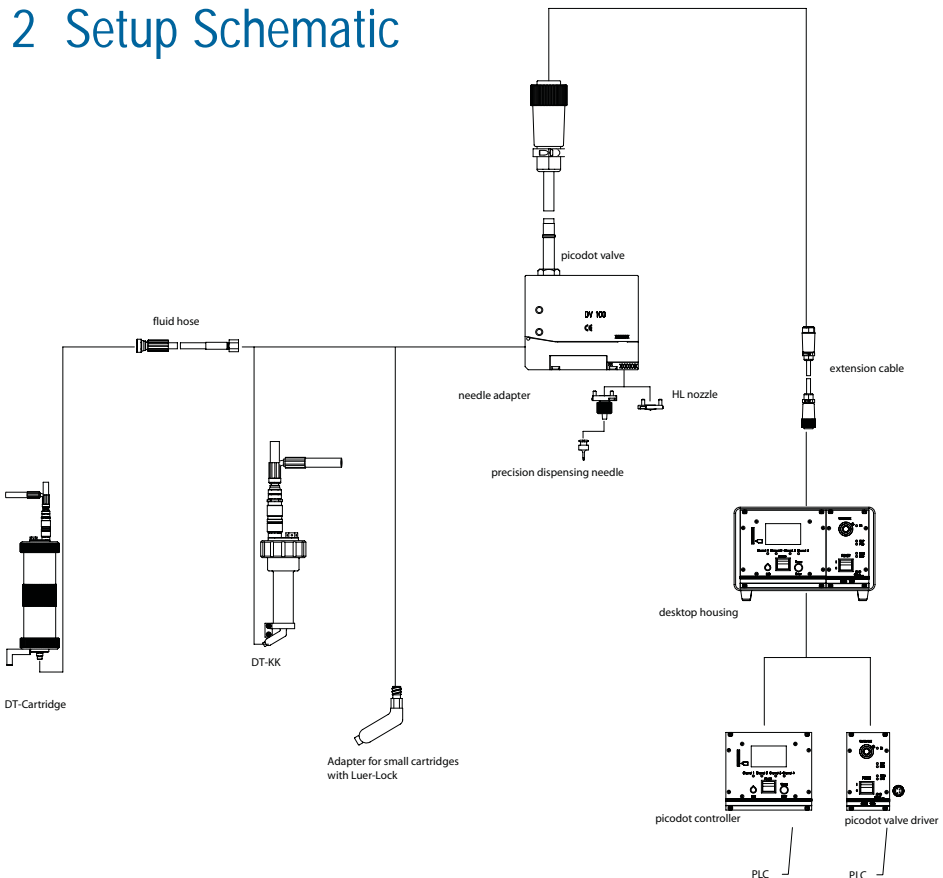
Never activate the valve without fluid! Activating the valve without fluid could damage the nozzle plate and cause the valve to leak.

The PicoDot needle valve is designed for use with standard Luer-lock dispensing needles. For best results, use EFD precision dispensing tips.

⚠ CAUTION

Each valve and its associated nozzle plate are precision aligned at the factory and delivered as a matched assembly with identical serial numbers on the valve and nozzle plate. Be careful not to accidentally interchange valves and nozzles when cleaning or performing maintenance.

2 Setup Schematic



2.1 Specifications – PicoDot Needle Valve

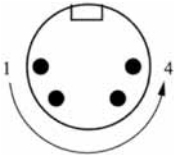
Dimensions (L x W x H) (with dosing needle):	72 mm x 16 mm x 95 mm (2.83" x 0.63" x 3.74")
Weight incl. cordset:	Approx. 314 g (11.1 oz)
Suitable fluids:	Lubricants (oils and greases), varnishes and colors, hydrous solutions, organic solvents, adhesives and adhesive components, liquid polymers and polymeric solutions and many other fluids
Fluid viscosity range:	Approx. 50 – 200,000 mPas / 50 – 200,000 cps (thixotropic)
Suitable fillers in the fluid:	Quartz powder, iron oxide, aluminum oxide, aluminum nitrite, nickel, silver, glass and polymeric particles up to a fill ratio of max. 50 percent and particle size of max. 50 microns
Minimum cycle time:	0.010 ms
Minimum cycle time for maximum stroke:	0.250 ms
Maximum cycle time:	Infinite (permanent dispensing)
Minimum pause time between two cycles:	0.010 ms
Maximum pause time:	Infinite (stop)
Max. dispensing frequency:	150 cycles per second (continuous operation)
Dispensing accuracy:	Approx. 2% (with constant pressure and temperature)
Maximum fluid pressure:	10 bar/1 MPa (145 psi)
Throughput:	Dependent on fluid
Ambient operating temperature:	Up to 45°C (113°F)
Fluid temperature:	Ambient temperature
Ball/nozzle seat configuration:	Self-adjusting, made of hard ceramics, nozzle plate removable for cleaning
Standard nozzle orifice diameter (other orifice diameters available):	0.300 mm (0.012")
Control interval nozzle seat: (depending on the fluid):	10 - 500 million cycles
Control interval piezoelectric actuator (depending on the operating frequency and temperature):	Approx. 100 – 350 million cycles
Materials in contact with fluid:	Perfluoroelastomer, stainless steel 303 (1.4305)
Valve cordset:	0.5 m cable with 10-pin circular connector; extension cables available
Min. bending radius of valve cordset:	R 35 mm (one-time); R 100 mm (deliberate movement)
Fluid inlet port thread:	M 10 x 1
Mounting thread at the valve body:	M 4; 6 mm deep
Protection class:	IP 54
Explosion protection:	No
Storage temperature:	-10°C - 85°C (14°F - 185°F)
Matching valve driver:	PicoDot Needle Valve Driver
Suitable process controller:	PicoDot Valve Controller

2.2 Specifications – PicoDot Needle Valve Driver

Dimensions (W x H x D):	71 mm x 129 mm x 171 mm (2.80" x 5.08" x 6.73") (for 19" rack installation, 3 HE, 14 TE)
Weight:	990 g (35 oz)
Power consumption:	Max. 30 VA
Supply voltage:	+24 VDC \pm 10%
Power connection:	4-pin male connector (company Binder, Series 690) with lock ring
Valve connection:	10-pin female connector (company Hirose) with lock ring 5A/490 VDC
Interface input/output:	15-pin sub-d-socket
5 V Bat. connection:	2-pole low voltage 5.5/2.1 mm with switch
Output for oscilloscope:	0 to + 4 VDC (1/100 of output voltage for piezo)
Piezo electric actuators:	
Output voltage:	Max. 400 V \pm 1%
Output current:	Max. 1.5 A
Output power:	Max. 20 VA
Build-up time:	0.120 ms \pm 10%
Trigger pulse duration:	Min. 0.010 ms
Protection class:	IP 40
Explosion protection:	No
Operating ambient temperature :	10°C to 35°C / 50°F to 95°F
Storage temperature:	10°C to 60°C / 14°F to 140°F

2.3 PicoDot Needle Valve Driver Interfaces

2.3.1 Power Interface

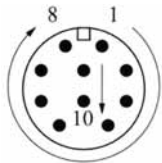


4-pin male connector for miniature circular plug connection with locking ring.

PIN	Signal	Level	Comment
1	P24	-	external power supply +24 VDC
2	P24	-	external power supply +24 VDC (connected with pin 1)
3	GND	0 V	ground
4	GND	0 V	ground (connected with pin 3)

PicoDot needle valve drivers are protected against overload. In case of overload, they will automatically turn off. If this happens, turn off the main switch on the front of the valve driver, wait one minute, and turn the switch back on. If the driver automatically turns off again, the valve may be defective.

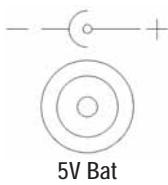
2.3.2 Valve Interface



10-pin female connector with locking ring 5A/490 VDC.

PIN	Signal	Level	Comment
1	ENA	0 V	active only after valve connection
2	GND/a	0 V	ground
3	na	-	not used
4	na	-	not used
5	na	-	not used
6	na	-	not used
7	na	-	not used
8	PE	-	ground wire
9	Ua	0 / + 400 VDC	voltage for piezoelectric actuator
10	P400/a	+ 400 VDC	voltage for piezoelectric actuator

2.3.3 5 V Bat. Connection

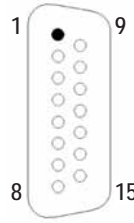


5V Bat

This is a low voltage connection (5.5/2.1mm) with switch for external power supply if an unintended voltage drop occurs on the

power input. Use the 5 V Bat. connection only after consultation with EFD.

2.3.4 Input/Output



15-pin sub-d-socket (DIN 41652).

	PIN	Signal	Level	Comment
Input	3	Uset	0/24 V Ri = 20 kΩ	digital voltage input 0–5 V valve closed 12–30 V valve opened
	4	DGND	–	ground for digital inputs/outputs and external power supply + 24 V DC
	15	P24ext	+24 VDC/ 500 mA	external power supply + 24 VDC, necessary to get output signals with a level + 24 V DC
Output	9	failure PC	0/5 V	internal signal, not short-circuit-proof!
	13	failure SPS	0/24 VDC/ 500 mA	output malfunction, following functions are checked: <ul style="list-style-type: none"> • valve connected (ENA) • drive current 24V = regular, 0V = malfunction To reset the malfunction signal switch off the control unit and turn it on again after fixing the problem
	14	status SPS	0/24 VDC/ 500 mA	status signal metering signal with length 3 ms after each metering

2.4 Connecting the PicoDot Needle Valve and Driver

1. Install the PicoDot needle valve driver in the desired location. Insert the power supply cable into the connector on the back of the valve driver and carefully tighten the locking ring. Connect the power supply plug to a power source.
2. Install the PicoDot jet needle valve in the desired location. Be careful not to pull or pinch the cable.
3. Insert the PicoDot needle valve cable into the connector on the back of the valve driver and carefully tighten the locking ring. Extension cables are available from EFD.
4. Connect the PicoDot needle valve driver to the PicoDot valve controller using the 15-pin DIN connector and carefully tighten the locking ring.
5. Turn on the PicoDot needle valve driver. The green LED will light up.



⚠ CAUTION

Never activate the valve without fluid. Activating the valve without fluid could damage the nozzle plate and cause the valve to leak.

Due to the particular arrangement of the piezoelectric actuator, PicoDot needle valves will not close completely when power to the valve driver is shut off. In case of power outage, a rechargeable battery in the valve driver will keep the valve closed for up to 20 minutes. After this time fluid might leak. To avoid contamination of parts or the production machine, fluid pressure should be released if the voltage drops at the valve driver power supply. Fluid pressure should also be released if the system is shut down between shifts or overnight.

Before using the PicoDot needle valve, turn off power to the valve driver and depressurize the fluid reservoir to determine whether fluid flows out of the valve with fluid feed pressure removed. If this occurs, the fluid reservoir should be installed lower than the valve.

The valve will not close correctly if the valve or valve driver is damaged. This will cause fluid to leak. To avoid contamination, you should constantly monitor the status of the valve driver via the interface cable. If a fault is detected, fluid pressure should be turned off immediately.

2.5 Sample Programming to Create a Signal with a PLC

Application description:

Apply three dots (0.07 mg) of engine oil (SAE 10W-40) into the bore of a bearing with a diameter of 0.7 mm.

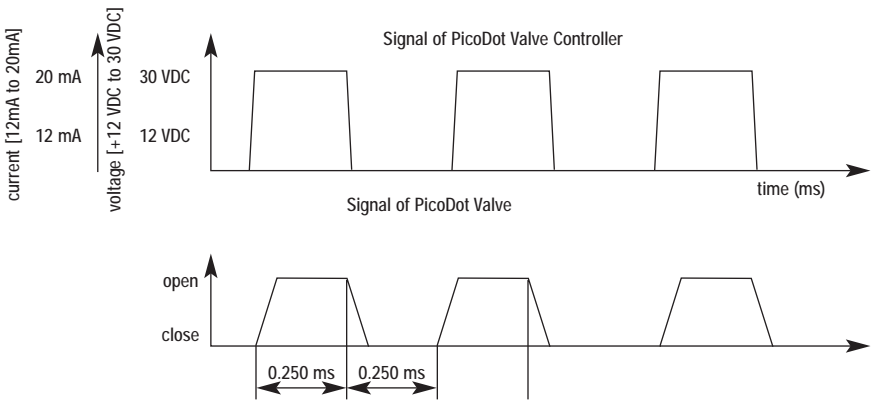
Preliminary tests determined the following process data:

Pressure: 0.1 MPa (14.5 psi)
 Temperature: +50°C (122°F)
 Dosage Time: 0.220 ms
 Pause Time: 0.350 ms

Dosage time:

Dosage time corresponds to the duration of the signal to Pin 3 (>12 VDC). The PicoDot jet valve will be open for the duration of the signal, allowing fluid to flow. When the external trigger signal level drops to low (<5 VDC), the valve closes.

To apply three drops, this process is repeated three times. Reducing the dosage time will reduce the dot size. If the pause time is less than 0.120 ms, the valve will not close completely.



3 Cleaning

Cleaning is limited to the valve components that come in contact with the fluid. The fluid channel is rinsed and the nozzle plate is cleaned with a soft, lint-free cloth.

CAUTION

Never activate the valve without fluid! Activating the valve without fluid could damage the nozzle plate and cause the valve to leak.

CAUTION

Never attempt to unscrew the cordset from the valve. Doing so could damage the electrical contacts and make the valve inoperable.

NOTE

Cleaning time depends on the fluid being dispensed.
Fluids with higher viscosities will require more time and cleaning fluid.

3.1 Removing Bubbles from the Needle

The valve can remain installed in the machine.

1. Unscrew the dispensing needle from the needle adapter.
2. Dispense a small amount of fluid so that there is some fluid on the outside of the needle adapter.
3. Fill the dispensing needle with cleaning fluid.
4. Screw the dispensing needle back onto the needle adapter.
5. Open the valve until all of the cleaning fluid has been used and the dispensing fluid starts to come out of the needle.

3.2 Rinsing the Fluid Channel

1. Shut off pressure to the fluid reservoir. Replace the fluid being dispensed with the appropriate cleaning fluid recommended by the fluid manufacturer. Place a cup under the valve to collect fluid.
2. Pressurize the fluid reservoir that contains the cleaning fluid. Use at least 30ml of cleaning fluid to rinse the valve.
3. Turn the MENU knob on the valve controller until the Cleaning menu is displayed. Press the knob to select the Cleaning menu, then turn the knob until the valve to be cleaned is highlighted and press to select. When the CLOSED field is displayed, press and hold the MENU knob to open the valve until cleaning fluid flows from the valve. The cleaning fluid will typically exit the valve at higher speed than the fluid that was being dispensed. Close the valve as soon as the cleaning fluid regains its original color.
4. For best results, allow the cleaning fluid to remain in the closed valve for five minutes.
5. From the Cleaning menu, press and hold the MENU knob to open the valve and purge the remaining cleaning fluid.

NOTE

**If no cleaning fluid remains in the fluid reservoir, compressed air will escape.
To prevent mess, put a cloth or cup in front of the nozzle.**

6. Repeat the rinsing process three times.
7. Remove the needle adapter (if installed) and nozzle plate. Clean the nozzle plate inside and outside with a soft, lint-free cloth and reassemble in reverse order.

3.3 Cleaning the Nozzle

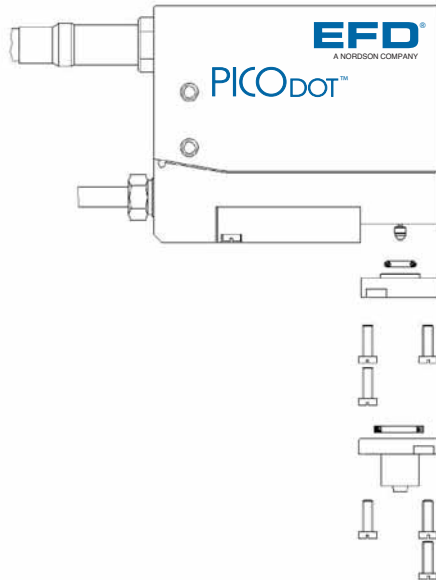
⚠ CAUTION

Each valve and its associated nozzle plate are precision aligned at the factory and delivered as a matched assembly with identical serial numbers on the valve and nozzle plate. Be careful not to accidentally interchange valves and nozzles when cleaning or performing maintenance.

⚠ CAUTION

After removing the screws, do not use tools to remove the nozzle plate from the valve. Using tools can cause serious damage. Always pull the nozzle plate down vertically, to avoid bending the rod.

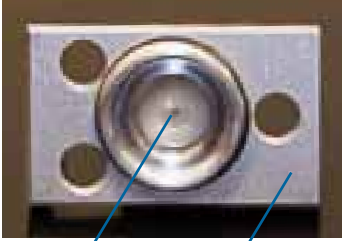
If the nozzle plate cannot be removed easily by hand, insert the three screws of the nozzle plate into the threads of the needle adapter. With this method you will be able to push the nozzle plate off the valve. When the nozzle plate is removed, be careful not to damage the exposed rod and sealing ball, as this could result in leakage.



1. Complete the rinsing process as described above.
2. Turn off the valve driver, and disconnect all electric and pneumatic lines.
3. Remove the nozzle plate.

The fluid channel, sealing ball and threads can be cleaned with cleaning fluid, a lint-free cloth, a cotton swab and a pipe-cleaner.

4. Clean the nozzle plate, screws and fittings (without O-ring) in an ultrasonic bath.
5. With the nozzle plate removed, rinse the valve with cleaning fluid.



Nozzle Seat

Nozzle Plate

6. Attach the fitting to the fluid inlet port on the valve and mount the cleaning fluid reservoir on the fitting.
7. Place a container under the sealing ball of the valve, pressurize the reservoir and rinse the valve.
8. Blow out the fluid channel of the valve with pressurized air.
9. Reassemble the system (don't forget the O-ring)
10. Connect the PicoDot valve to the valve driver.

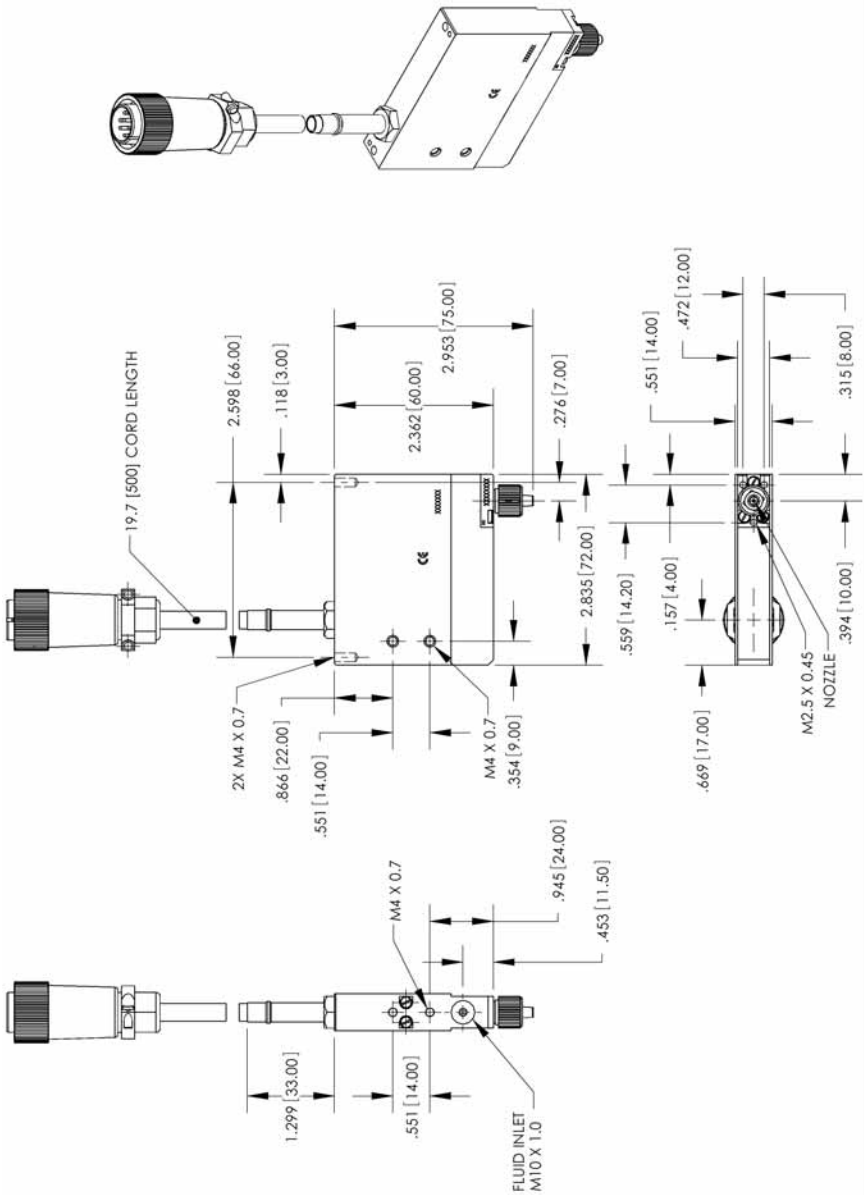
3.4 Testing for Leaks

Always check for leaks after performing the cleaning procedure.

1. Replace the fluid being dispensed with the appropriate cleaning fluid.
2. Close the valve and pressurize the fluid reservoir to approximately 6 bar (87 psi).
3. No fluid should be visible at the orifice of the nozzle plate. If fluid is visible, repeat the cleaning procedure.
4. If the valve leaks, check the nozzle seat with a magnifying glass for any remaining contamination, particles and damage and remove contaminants. Replace all fluid lines from the reservoir to the valve.
5. If the valve still leaks, contact EFD for technical assistance.

Appendices

A-1 PicoDot Needle Valve Drawing



A-3 PicoDot Needle Valve Driver Drawing

