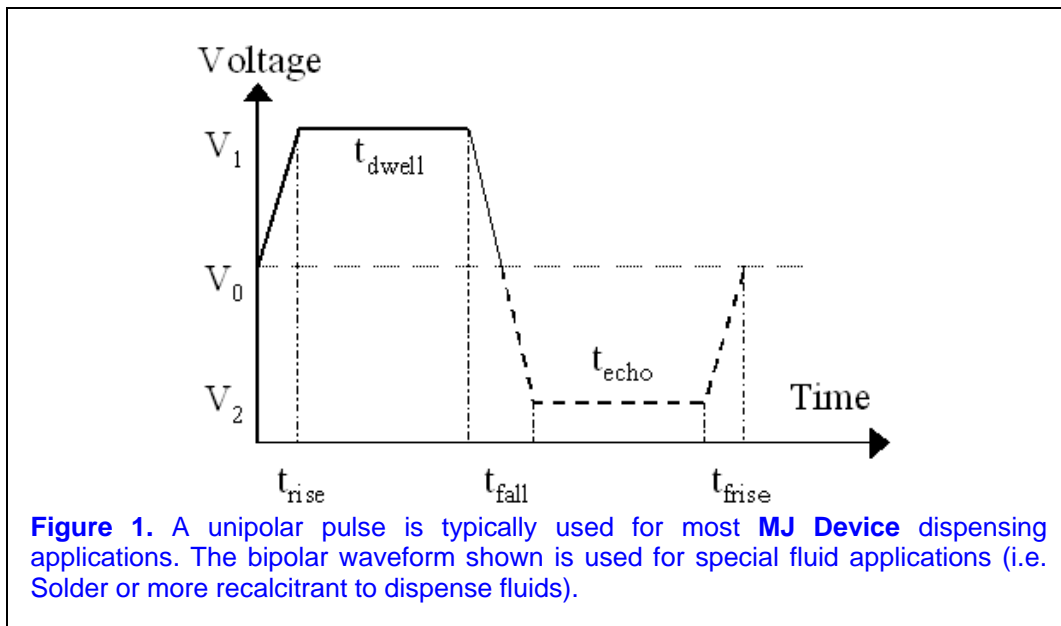


MJ Device Integration Guide

MJ-AB, MJ-ABP, MJ-AT, MJ-ATP

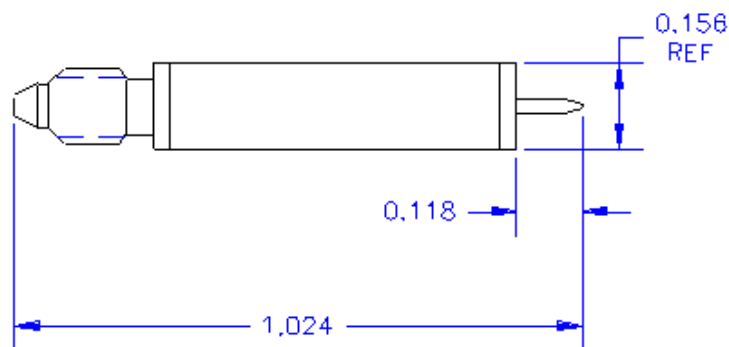
Electrical

In order to generate drops, a voltage pulse is sent to the **MJ device** with a shape shown in the **Figure 1** below. **MicroFab's JetDrive™ III** can supply this type of waveform with a wide range of waveform parameters and thus can address a wide range of applications. Other drive units may be employed if they can drive an approximately 1 nF load with voltages and timing appropriate for the working fluid and application. See [Technote 99-03](#) on the **MicroFab Technologies, Inc.** web page for more information.

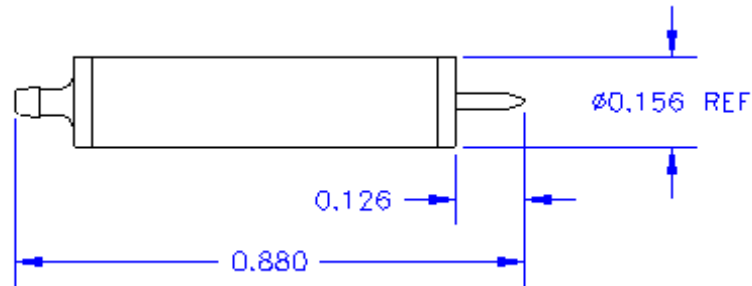


Mechanical

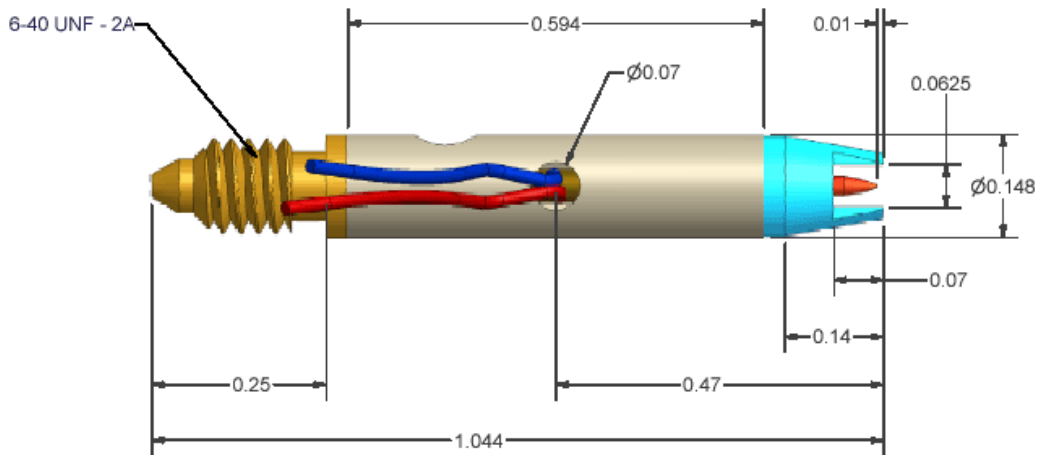
MJ (-AB, , ABP, -AT, and -ATP) dispensing devices can be mounted into **MicroFab's PH-06** and **PH-07** printhead assemblies. Alternately, they can be mounted into customer designed fixtures using the dimensions in the images below. The **-AB** and **-AT** devices are usually held by the cylindrical section using a nylon set screw (the body is aluminum). The **-ABP** and **-ATP** can be held in the same manner using a metal set screw (body is stainless steel). A feed through for the wires must be a part of the mounting fixture. The wires come out at the center of the cylindrical section of each device type. The **-ATP** device can also be mounted using the Z and theta reference surfaces that are part of the tip protector. Finally, the **-AT** and **-ATP** can be mounted by holding the male **MINSTAC** union.



MJ-AT



MJ-AB



MJ-ATP

Fluidic Interconnects, Filters, and Reservoirs

Note: The fluid to be dispensed must be purged from the reservoir through the tubing and to the orifice of the device. The **MJ** device is not self-priming and will not “pump” or move the fluid to the orifice.

Threaded Fitting (MINSTAC) MJ Devices; MJ-AT and MJ-ATP

The **MINSTAC** fitted **MJ-AT** devices have a male threaded end fitting that can be attached to tubing and fittings available from **The Lee Company** (www.theleeco.com).

A **062 MINSTAC Tubing Union (Part # TMUA3201950Z)** can be used to interface the **MINSTAC** fitting on the **MJ-AT** device with a **MINSTAC Male Coupling Screw** attached to Teflon tubing, as shown in the top image of **Figure 2**. Stocked pre-assembled tube sets having **MINSTAC Male Coupling Screw** fittings on both ends of Teflon tubing (0.062” OD) are available (**TUTC3216910L - 10 cm, TUTC3216915L - 15 cm, TUTC3216930L - 30 cm, TUTC3216960L - 60 cm**).



Figure 2. MJ-AT type device having a **MINSTAC** couple. Top: **MINSTAC 062** couple male to male. Bottom: **MINSTAC** couple male to luer.

The **062 MINSTAC Fitting End Kit (Part # TMZA3202010Z)** can be used to attach the male fittings to Teflon tubing in order to obtain custom lengths. Additional Teflon tubing can be ordered from Lee (**TUTA3216930D 10 feet of Tubing**).

Another option is to interface the **MINSTAC** fitting on the **MJ-AT** device using the **125/156 MINSTAC Female Tube - Luer Adapter (TMRA9502950Z)** with the **125/156 MINSTAC to 062 MINSTAC Adapter (TMDA3203950Z)** to connect to male Luer fittings, as shown in the bottom of the **Figure 2**.

Barb Fitting MJ Devices MJ-AB

The barb fitting of **MJ-AB** devices can be attached directly to **C-Flex tubing**, as shown in the **top** device in the **Figure 3**. Another option is to slip the **PTFE microbore tubing, 0.022 x 0.042 in (0.55x1 mm) E-06417-21** into a small section (6.0mm) of **C-Flex tubing, 0.031 x 0.094 in (0.7x2.3 mm) E-06422-01** that has been slipped over the barb fitting on the device, as shown in **bottom** device in the **Figure 3**. The **C-Flex tubing** or **PTFE microbore tubing** can then be connected to the **syringe barrel adapter** described below by inserting the metal needle end of a female luer fitted blunt needle into the **C-Flex tubing (18 gauge needle part # 5118-B)** or **PTFE microbore tubing (22 gauge needle part # 5122-B)** from **EFD, Inc. (www.efd-inc.com)**. A syringe filter can be placed in-line between the female luer fitted blunt end needle connected to the tubing and the male luer fitted syringe body. The tubing should be flushed thoroughly with filtered fluid to remove particulate material prior to connecting to the device.

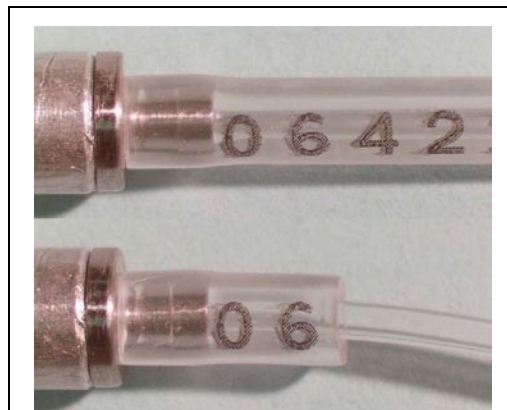


Figure 3. MJ-AB barb fitted device. Top: **PTFE tubing** slipped over barb; Middle: **CFLEX tubing** slipped over barb; Bottom: **PTFE tubing** slipped into **CFLEX tubing** slipped over barb.

Reservoirs: Syringe Type

A **syringe barrel adapter assembly** available from **EFD, Inc. (www.efd-inc.com) (cat. # 1000Y5149 to 52)** can be attached to a **syringe barrel reservoir** (see [table](#) at end for catalogue numbers) to provide for a reservoir to the **MJ** device (**Figure 4**). The syringe barrel reservoirs and adapter assemblies are available in 3cc, 5cc, 10cc, 30cc and 55cc volumes. The syringe barrel reservoir and adaptor assemblies can be attached to a **MicroFab Pressure Control Unit** or other house vacuum/pressure control. The fluid can then be purged from the reservoir through the **MJ** device. Back-pressure and vacuum can also be controlled to maintain the proper meniscus at the orifice of the **MJ** device. A proper meniscus can also be maintained without pressure regulators by adjusting the height of the reservoir relative to the orifice. [Note that it is the height of the top surface of the fluid in the reservoir that controls the static pressure at the orifice.] An in-line filter (5.0 μ m mesh) should be used to prevent clogging the orifice. Tubing should be flushed thoroughly with filtered fluid before connecting to the device.

Reservoirs: Tubing Type

For small volumes a 6.5cm section of **PTFE microbore tubing, 0.022 x 0.042 in (0.55x1 mm) E-06417-21** can be inserted into a small section (6.0mm) of **C-Flex tubing, 0.031 x 0.094 in (0.7x2.3 mm) E-06422-01** that has been slipped over the barb fitting on a barb fitted **MJ-AB** device. Another 6.0mm section of **C-Flex tubing, 0.031 x 0.094 in (0.7x2.3 mm) E-06422-01** is slipped onto the distal end of the **PTFE microbore tubing**. This section of tubing will provide a reservoir including the dead volume within the **MJ-AB** device. The length of the tubing determines the volume of the reservoir. A micropipette is used to load the tubing reservoir attached to the **MJ-AB** device by inserting the pipette tip into the **C-Flex tubing**. Carefully remove the pipette tip while keeping the plunger in the pressed position after loading the tubing reservoir with fluid. Be sure to filter all fluids prior to use to prevent clogging the orifice.

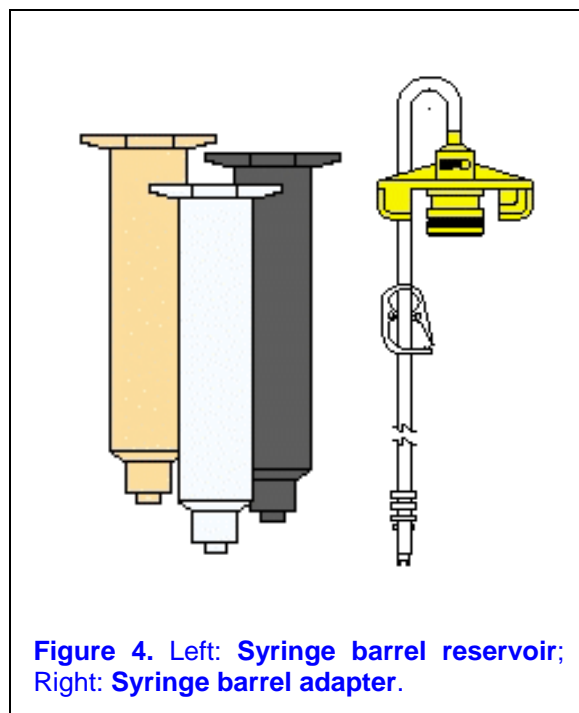


Figure 4. Left: Syringe barrel reservoir; Right: Syringe barrel adapter.

Filters

Water-based fluids can be filtered using 5.0 μ m pore size **nylon syringe filters (GE Osmonics DDR50T3050)**. Solvent-based fluids can be filtered using 5.0 μ m pore size **PTFE syringe filters (Millipore Millex-LS SLLS 025 NS)**. New syringe filters should be flushed prior to use to remove particles from manufacturing. Small volumes (50-500 μ L) can be filtered (0.22 μ m) using **microcentrifuge filters (Millipore Ultrafree-MC UFC30GV00)**.

Dispensing Environment

Particulate contamination can block the orifice of the MJ dispensing device and interfere with operation. Thus, having a clean operating environment is essential.

- Avoid handling dispensing fluids, tubing, and dispensing devices in areas susceptible to dust or static electricity that attracts dust. Static charges are more prevalent in conditions of low relative humidity (<30%). Dust is more likely to occur in areas of high traffic, near doorways and air conditioning vents.
- Store the dispensing devices, tubing, fluid containers, and swabs in an enclosed dust free area when not in use.
- Filter air incoming from the pneumatics control system and all fluids that will enter the device using a 5 μ m or smaller pore size filter.
- Be certain that all fluid handling materials (i.e., glassware, tubing, filters, etc) have been thoroughly cleaned and/or rinsed with filtered water or an appropriate solvent.
- Use appropriate lab apparel (lab coat, glove) to reduce contamination from your clothing or skin.

Dispenser Handling

The orifice of a MJ device is subject to clogging and blockage by particulate material present in the jetting solution. The filtration of the jetting solution prior to use is essential. Before dispensing you should:

- Flush new syringe filters prior to use to remove particles from manufacturing.
- Confirm the tubing and reservoir will withstand the solvents you choose. Otherwise dissolved material can contaminate the dispensing device.
- Flush the tubing and reservoir with a filtered solvent before dispensing, and then dry with filtered pressurized air. Filtered isopropyl alcohol (or other solvent) has a greater wetting capacity than water and is a better choice for removing particulates.
- Always clean the dispensing device before use. Back-flush the device by applying vacuum through the fluid connector and immersing the glass tip within a clean solvent. This back-flush method can also be used to remove orifice clogs. Warm solvents under low power ultrasonication work best, but understand the dangers of heating and sonicating volatile solvents. Do not to sonicate for more than 1 minute and never immerse more than the glass tip into the cleaning solution.

MJ devices must be cleaned immediately after use to ensure reliable dispensing and extended operational life. After dispensing you should:

- Back-flush the device with 1-3mL of the solvent of the solution that was dispensed followed by a 2% water solution (80°C) of Micro-90 cleaning solution (Cole-Parmer cat # U-18100-00) or equivalent. Observe the tip of the dispensing device after 1 minute of back-flushing to verify all residues, particles or condensations have been removed. Repeat the procedure until the tip is clear. Lastly, back-flush the tip using DI or MilliQ water for at least one minute, followed by a one-minute back-flush using acetone. Apply vacuum for one-minute to dry the inside of the device prior to storage or use.

- Difficult materials, such as proteins, DNA, antibodies, etc., can be removed with a 10% sodium hypochlorite solution before cleaning with 2% water solution (80°C) of Micro-90 cleaning solution. Rinse and dry the device as described above.
- Recalcitrant particles can be often removed after soaking the orifice in the cleaning solution for a few minutes to overnight prior to back-flushing.

Clogged Orifice Recovery Procedure

An orifice blockage that cannot be removed using the cleaning and back-flushing procedures described above may be removed using the following protocols. Please note that leaving solutions in the device for extended periods of time, such as overnight, can result in orifice clogging.

a) Immerse the tip of the device and backflush with a 2% solution (80°C) of **Micro-90 Cleaning Solution (Cole-Parmer cat. # U-18100-00)** in a beaker held in an Ultrasonic cleaner. Avoid the use of high power output Ultrasonic cleaners, as they can damage the fragile orifice. Also, minimize the amount of time the **MJ** device tip is exposed to Ultrasonic cleaning. Check the condition of the orifice after one minute. Repeat if necessary. A cotton swab can be used to wipe the tip of the device during this procedure to help free the clog.

b) If the orifice remains clogged, immerse the tip of the device in a 5% water solution (80°C) of **Micro-90 Cleaning Solution (Cole-Parmer cat. # U-18100-00)** for overnight. Then, perform the backflush procedure described in “a” above.

c) The **MJ** device can be returned to MicroFab if the cleaning procedures described above fail to unclog the orifice. The device will be cleaned, retested, and returned and a charge of \$75 will be applied (domestic return shipping included; \$40 per shipment international). The **Dispensing Device Return Form** located below must be completed and returned with the **MJ** device.

Precautions

Do not immerse the body of the **MJ** device into the **Micro-90 Cleaning Solution** or other solvent, as these fluids can damage the epoxy and nickel coating of the PZT. Water and/or IPA can be used to clean the **MJ** device casing.

Avoid the use of high power output ultrasonic cleaners, as they can damage the fragile orifice. Also, minimize the amount of time the **MJ** device tip is exposed to ultrasonic cleaning.

Operational Limitations

The **MJ-AB** and **MJ-AT** devices can be operated reliably at temperatures of up to 80°C and V_1 up to 70 Volts. At higher duty cycles / frequencies, lower limits on both temperature and voltage should be used.

EFD Syringe Body Catalogue Numbers

Syringe Barrel Adapter Assembly	3cc	EFD	7012341
Syringe Barrel Adapter Assembly	5cc	EFD	7012054
Syringe Barrel Adapter Assembly	10cc	EFD	7012339
Syringe Barrel Adapter Assembly	30cc	EFD	7012338
Syringe Barrel Adapter Assembly	55cc	EFD	7012338
Syringe Barrel Reservoir (Pack 50)	3cc	EFD	7012085
Syringe Barrel Reservoir (Pack 40)	5cc	EFD	7012103
Syringe Barrel Reservoir (Pack 30)	10cc	EFD	7012126
Syringe Barrel Reservoir (Pack 20)	30cc	EFD	7012145
Syringe Barrel Reservoir (Pack 15)	55cc	EFD	7012160

DISPENSING DEVICE RETURN FORM

CUSTOMER INFORMATION	
Company Name:	Contact Name:
Address:	E-mail Address:
	Phone #:
Date of Return:	Fax #:
DEVICE INFORMATION FROM CUSTOMER	
Serial #:	
Device Type:	
Failure Symptom:	
Device Jetting History:	
Glass Tip Conditions (Chips, Cleanliness):	
Glass Tip Orifice Clogged or Clear:	
Body Overall Cleanliness:	
Wire Connections:	
MICROFAB INSPECTIONS	MICROFAB RECOVERY WORKS
HANDLING OPINION	

MicroFab Dispensing Device Policy:

- 1) MicroFab will replace device with defects from original manufacturing or shipping;
- 2) MicroFab will not replace device with defects due to user's operation;
- 3) Clogged devices will be cleaned, retested, and returned and a charge of \$75 will be applied (shipping included in the US).
- 4) Please return to address given below, attention: Paul Watson, RETURNS.

MicroFab Technologies, Inc.
 1104 Summit Ave., Suite 110, Plano, TX 75074
 (972) 578 - 8076 (Phone) (972) 423 - 2438 (Fax)
www.microfab.com