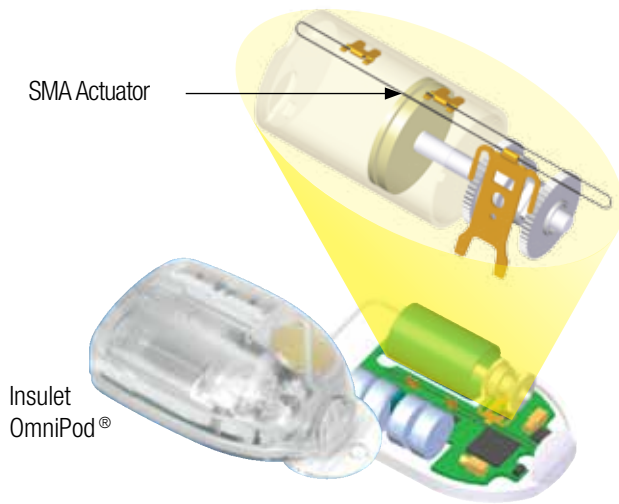


# Shape Memory Actuation





## Shape Memory Actuator Motor

The OmniPod Insulin Pump portable delivery system provides a “freedom of lifestyle” change for diabetics requiring Insulin use. The unique product was made possible with the use of a Shape Memory Alloy wire actuator jointly developed with Insulet and manufactured by Autosplice! Standard motors are too costly, too heavy, generate too much heat, and require far too much power to provide a portable solution. The SMA actuator makes this assembly possible from both a technical and cost effective standpoint. The SMA wire actuator drives the gear by alternately energizing one side of the wire assembly and then the other. This in turn drives the arms into the gear mechanism, which results in the turning of the shaft. The gear mechanism provides drive for operation of the pump.

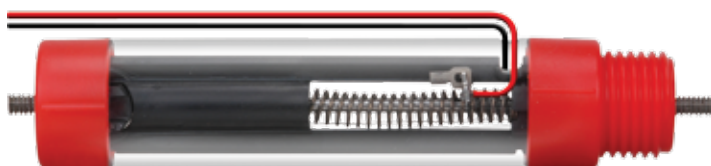
## Energy Efficient Latching Shape Memory Actuator

Actuator provides a latched condition for alternate positions of a plunger, with significant energy conservation, making it especially ideal for battery driven devices. Testing shows potential of 1/10th power consumption vs. traditional latching solenoids. Interface can be designed to fit a wide variety of applications, especially for water valves.

- Power consumption reduced to .035 Watt-seconds from .36 Watt-seconds.
- Battery life extended for product life.



VOLTAGE INPUT	FORCE	STROKE
1.5/3 VDC	100 g	0.118 (3mm)



3mm Stroke "Actual Size"

VOLTAGE INPUT	FORCE	STROKE
4.5 VDC	1 LBF (4.4 N)	0.118 (3mm)

## Autosplice Compact Actuator

Compact Shape Memory Actuators are designed to replace traditional tubular solenoids in areas such as: vending machines, cash registers, electronic door locks and many other applications.

Compact Actuators offer potential benefits, such as:

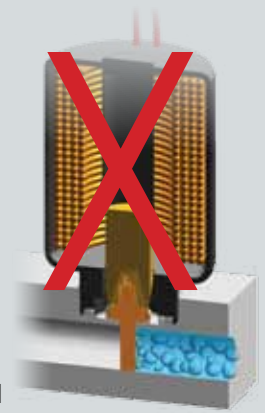
- Power efficient.
- Less heat.
- Lightweight.
- Are not force to stroke restricted.
- Have set on/off cycle time (not duty cycle limited).
- Provide push or pull.
- Quiet operation.

Autosplice has tooled a 3mm version and can also provide a custom solution tailor fit to your application for various forces, strokes, and power requirements.

## Irrigation/Water Valve Shape Memory Actuator

Ideal for solenoid replacement. Can be used as a drop in or be modified to fit specific design requirements. Flexible design use with AC or DC power input, offers quiet operation, is low cost and is energy efficient.

VOLTAGE INPUT	FORCE	STROKE
DC 1.5 - 3 VDC	100g	0.035 (0.89mm)
AC - VARIABLE		

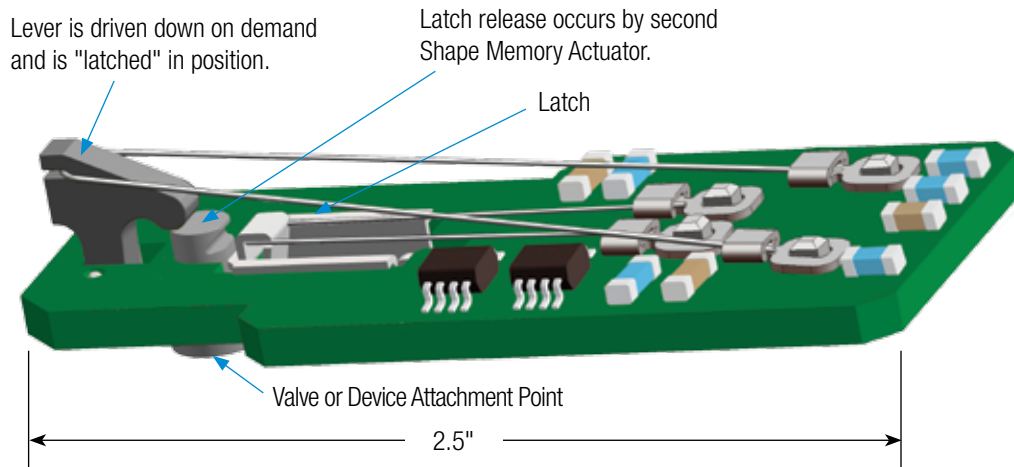


Old Solenoid Actuated Valve

## Custom Designs For Latching/Unlatching And Device Control Applications

Autosplice has developed a variety of custom latch solutions for devices that require overall control of operation and/or accessibility.

The device below provides control and operation lockout by integrating two Shape Memory Actuators with electronic control of all functions. One SMA is integrated with a lever system to actuate the actual device, while the second wire provides "latch" control and lockout until electronically released. This device also provides "burst control" in the actual application as well.



For this dispensing unit it was essential to develop a low profile release system. SMA wire eliminated the need for solenoids and increased the number of containers available in a given area, with flexible configuration management.

The Shape Memory Actuator opens the lid on programmable demand when access is required.

## Autosplice Shape Memory Actuation

In addition to offering custom control that is difficult to match via traditional devices, Shape Memory Actuators also offer low cost, low power, generate less heat, are extremely lightweight and offer quiet operation!

Discuss your latch release/latching requirements with an Autosplice representative and take advantage of a Shape Memory Actuation solution for your application!

## About Shape Memory Alloy (SMA) Wire Technology

Shape Memory Alloy (SMA) Wire Actuation Devices use a particular alloy of high strength corrosion resistant Nitinol (Nickel Titanium) material that contracts 4% when heated. In most applications the heat is conveniently and precisely generated by an electrical current. SMA wire is used reliably in a wide variety of applications including medical, computer, consumer, automotive and industrial products.

### Benefits

In many applications SMA wire provides actuation solutions that permit the elimination of solenoids and motors. They offer energy efficiency, lighter weight, space savings, cost savings and quiet operation while meeting the life cycling requirements of a wide variety of products. **Autosplice provides robust SMA wire assembly solutions for your application!**



The chart below shows typical performance characteristics based on set parameters. (Wire Contracts .040 inches per inch) However, there are ways to improve response time, actuation range (movement), power requirements, etc.

Performance Characteristics						Information from Dynalloy, Inc.	
Wire Diameter (Inches)	Resistance (Ohms/Inch)	Maximum Pull Force (grams)	Applied Current at Room Temperature (mA)	Contraction Time (seconds)	Off Time 70°C Wire (seconds)	Off Time 90° Wire (seconds)	
0.0010	45.0	7	20	1	0.10	0.06	
0.0015	21.0	17	30	1	0.25	0.09	
0.002	12.0	35	50	1	0.3	0.1	
0.003	5.0	80	100	1	0.5	0.2	
0.004	3.0	150	180	1	0.8	0.4	
0.005	1.8	230	250	1	1.6	0.9	
0.006	1.3	330	400	1	2.0	1.2	
0.008	0.8	590	610	1	3.5	2.2	
0.010	0.5	930	1000	1	5.5	3.5	
0.012	0.33	1250	1750	1	8.0	6.0	
0.015	0.2	2000	2750	1	13.0	10.0	
0.020	0.16	3562	4000	1	17.0	14.0	

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