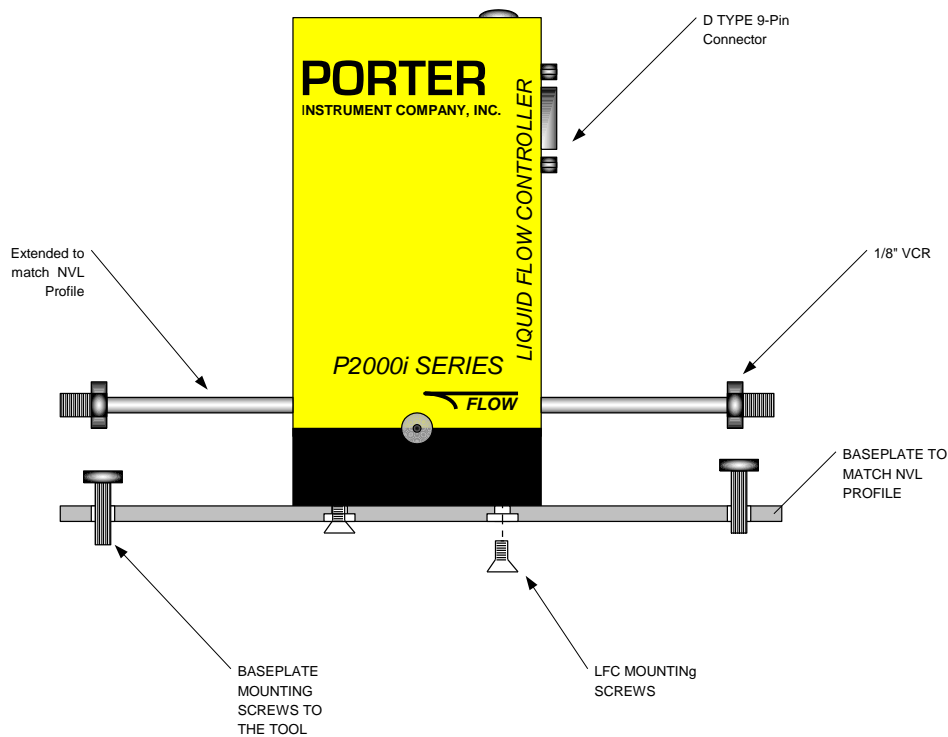


PORTER INSTRUMENTS MODEL P2000i UPGRADE FOR THE
NOVELLUS CONCEPTS 1

Introduction

The Porter Instruments NVL-00x to the Porter Instruments P2000i upgrade is for the sole purpose of replacing the older style NVL used in the Novellus Concept 1 with the newer and more reliable P2000i used in the Novellus Concept 2. The two LFCs have the same function but completely different technologies. *Figure 1* illustrates the basic P2000i LFC upgrade mounting assembly.



PORTER INSTRUMENTS, INC.
NVL to P2000i Adaptation

Figure 1

On the P2000i LFC upgrade, the inlet and outlet ports are extended by cutting and welding new fittings. This LFC is lengthened from fitting to fitting in order to allow it to be



dropped into place where the NVL was once connected. The device is then leak checked, calibrated, and shipped with a new mounting base plate to match the Bronkhurst style NVL LFC footprint. The D-type 9-pin connection does not require any modifications.

Value Added Product and Support

Liquid Flow Technology, Inc. is not the OEM nor is it a distributor for The Porter Instruments P2000i or the NVL -00x LFC's. We are simply offering a more economical solution to the industry that currently uses the Novellus Concept 1 and will soon use or purchase a refurbished Novellus Concept 1 or for the actual Novellus re-manufacturer.

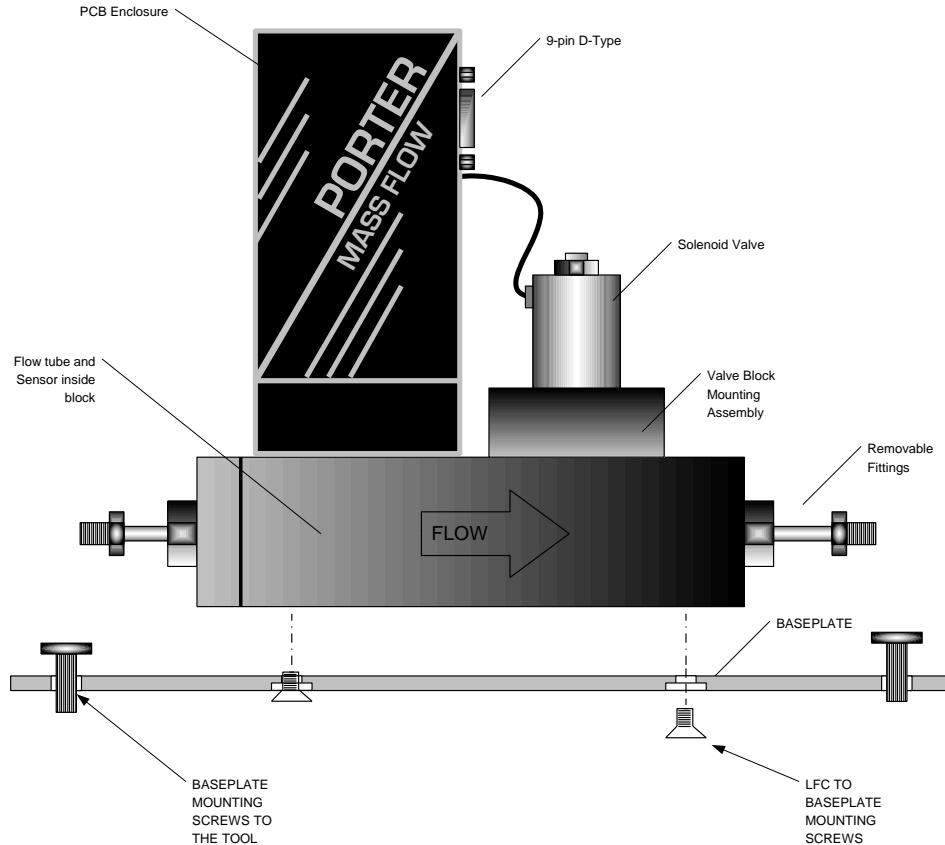
Liquid Flow technology, Inc. searches the various related industries and acquires surplus or overstock devices in order to better fulfill the needs of our clients. We purchase used or overstock Porter Instruments model NVL-00x and P2000i's, refurbish them and/or re-range them to OEM specifications. We currently have a working relationship with Porter Instruments and purchase parts for both the NVL's and the P2000i's. Unfortunately, the NVL parts are expensive. They are no longer manufactured by Porter because they were manufactured solely for the Novellus Concept 1. There are still some cores available from Porter costing over 6K USD with long lead times. The P2000i is still manufacturer by Porter, but the cost of a new device is nearly 4K USD and they are specifically used by the Novellus Concept 2. Most of the Novellus Concept 1 systems are being refurbished by independents which purchase used or overstock Porter NVL LFC's in order to keep the cost down for their clients. This is where Liquid Flow Technology, Inc. comes in to action. We provide not only the service and sales of these devices, but offer value added solutions such as the P2000i upgrade for the Novellus Concept 1s.

The Original Porter Instrument Model NVL LFC

The Novellus Concept 1 NVL LFC is a modified gas mass flow controller designed by Bronkhurst and modified for Porter Instruments to the requirements of the Novellus Concept 1. It consists of a thermal sensor flow tube and a solenoid / plunger assembly as found in the earlier gas style MFC's.

Liquid Flow Technology, Inc. provides our customers with a drop in solution to replace the bulky obsolete NVL LFC with the P2000i.

Figure 2 illustrates the basic mounting assembly of the Bronkhurst style NVL LFC for the Novellus Concept 1.



General Type NVL LFC Cabinet Mounting

Figure 2

Model NVL versus the P2000i

The Porter Instruments Model NVL has several drawbacks as a liquid flow controller. It was originally designed as a gas mass flow device which was modified for liquids. The design is an early thermal flow sensor with a solenoid / plunger assembly (illustrated in Figure 3a) which categorizes it as a very primitive LFC and was never adopted widely. The thermal flow sensor has been replaced by the Peltier Sensor found in many of the more contemporary LFC's and while it is primitive, the thermal flow sensor in the NVL works well because it is a straight sampling tube rather than the typical U-shaped designs of the earlier MFC's. The valve assembly in the NVL is another story. It is a solenoid /plunger assembly with can be very erratic and will occasionally create air cavities in the liquid line within the LFC. When air gets trapped in the device it will simply stop flowing. The power requirements for the NVL solenoid are high because an electromagnetic coil is used to lift the plunger away from the orifice (illustrated in Figure 3a).

The orifice is a threaded piece with a hollow core, which allows the liquid to flow through it as shown in Figure 3b. When the demand for more flow is required, the valve driver circuit supplies more power to the solenoid which in turn generates a magnetic field and pulls the plunger upward into the solenoid cavity. This will continue for a time until the

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mechanics of the assembly begin to wear. The assembly begins to wear when the demand for more current to the solenoid coil requires more power. This will continue until either the supply of current is diminished or the valve driver fails. Typically the LFC will simply shutdown or improper purging causes a steady build up of residual dry liquid in the sensor and in the orifice. This buildup forces the LFC to open the valve further than the flow control loop can provide and the LFC will ultimately shutdown.

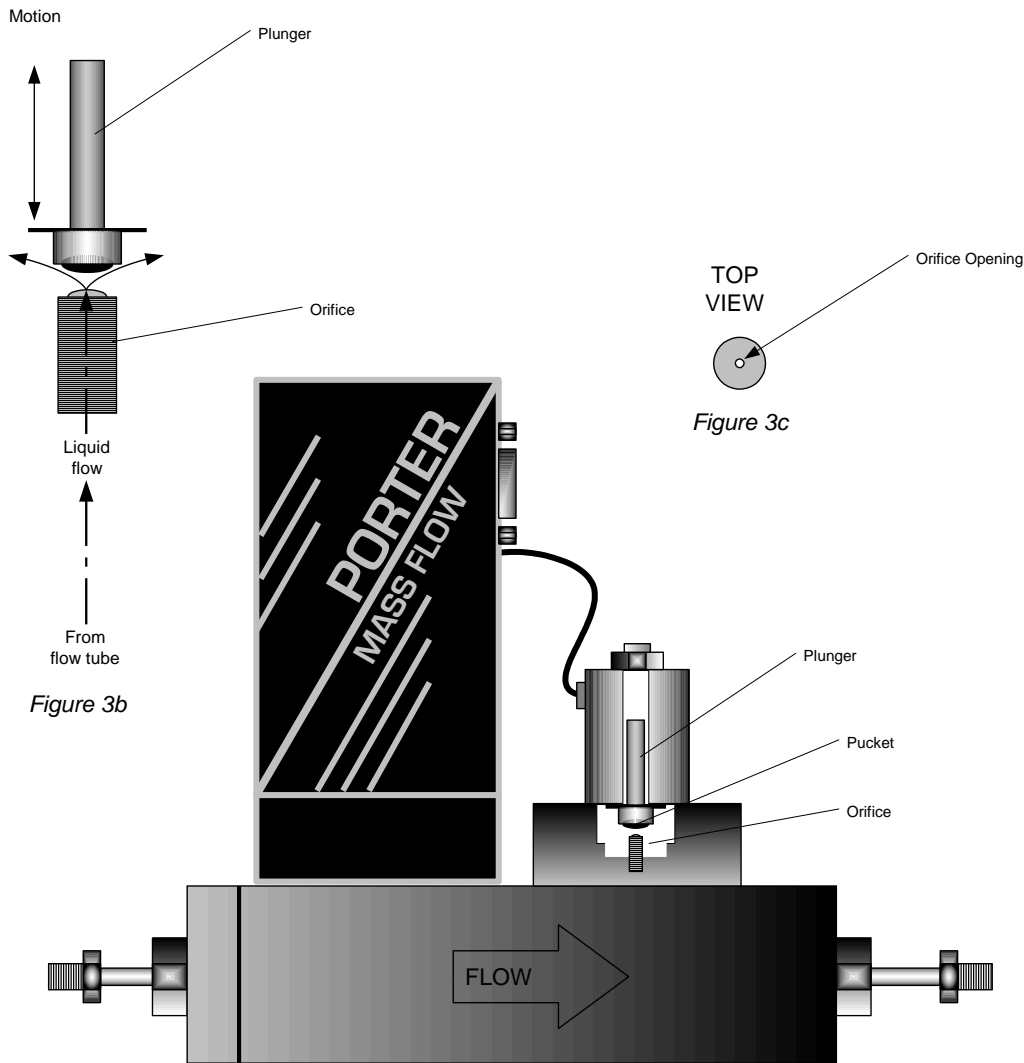


Figure 3a

General Cutaway View of Valve Assembly

Figure 3

This contamination process does not take long. The dimension of the orifice is so small (Figure 3c) that a very small amount of contamination or upstream particles can easily clog the orifice and completely cutoff the NVL flow.

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The Porter Instrument LFC model P2000i is a different design all together. It uses a unique patented flow sensor design which provides the 1% linearity and a piezoelectric valve which allows for highly stable flow controller. The P2000i's leak integrity is higher than the NVL LFC because there are fewer parts and seals between the individual components. The liquid flows through the P2000i from the inlet straight through the outlet with only a piezoelectric valve restricting the flow, unlike the various miniscule restrictions and multiple corners encountered in the NVL LFC flow.

Liquid Flow Technology, Inc. sells the P2000i upgrade for the same cost as an NVL-00x, making it a very simple budgetary decision. Any P2000i upgrade you purchase would be calibrated and repaired for the prices already established by Liquid Flow Technology, Inc for the standard P2000i. These prices are lower than that for servicing of the NVL series LFC.

Please feel free to email me with any questions regarding this upgrade or any other services we do or might offer. ron@liquidflowtechnology.com