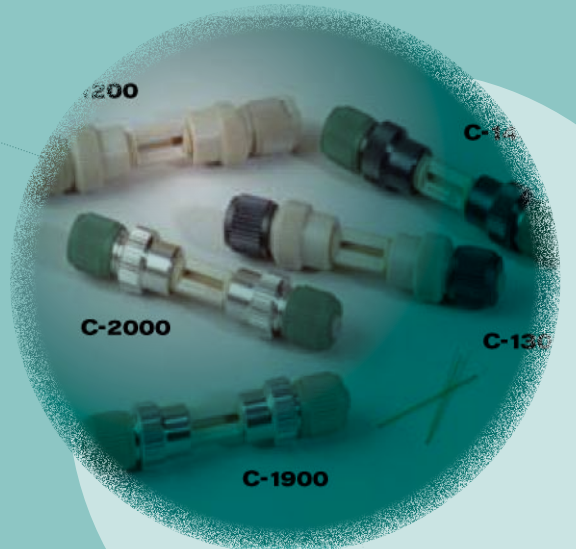
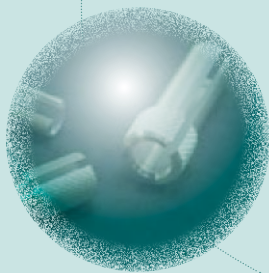


Upchurch® MICRO FLOW



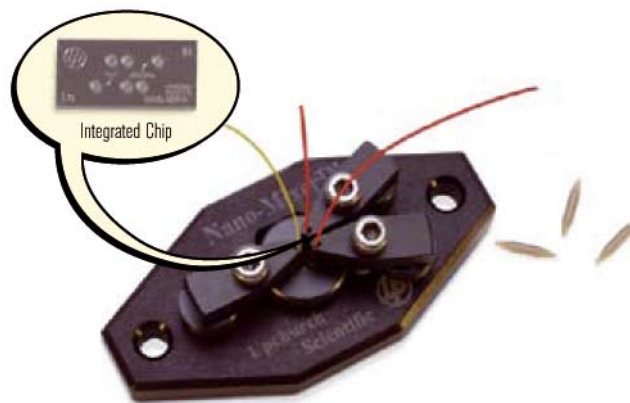
NANOMIXER™

The Upchurch Scientific® NanoMixer uses hyper-diffusion between flow laminae to obtain superior mixing with reduced turbulence. Independent tests show the NanoMixer offers improved peak shapes and more distinct gradient profiles than other available mixers — while contributing less to detector noise level.

The NanoMixer is ideal for high pressure gradient systems or post-column derivatization, i.e., applications where two flow streams combine into one. This mixer is well suited for submicroliter flow rates, but it also delivers superior performance up to 500µL/min.

Using Upchurch Scientific patent-pending technology, the silicon chip-based NanoMixer allows direct connection of 360µm OD capillary tubing using our NanoFerrules™ with no tubing sleeves required. Tubing for the NanoMixer is (PEEK™ and fused silica) and (Teflon® PFA).

The NanoMixer offers two flow path options, selected by simply changing the orientation of the enclosed glass/silicon chip. One configuration provides mixing with relatively low back pressure and has a flow path volume of 30nL. The second option offers more efficient mixing with a higher back pressure and a flow path volume of 60nL. Both configurations are pressure rated to 4,000 psi (276 bar).



Research Using NanoMixer Technology:

Time-Resolved Fourier Transform Infrared Spectrometry Using a Microfabricated Continuous Flow Mixer; Application to Protein Conformation Study on the Example of Ubiquitin

M. Kakuta, P. Hinsmann, A. Manz, B. Lendl
Lab Chip 3, 82-85 (2003)

Micromixer-Based Time-Resolved NMR: Applications to Ubiquitin Protein Conformation

M. Kakuta, D.A. Jayawickrama, A.M. Wolters, A. Manz, J.V. Sweedler
Anal. Chem. 75, 956-960 (2003)

On-Line On-Chip Post Column Derivatization Reactions for Pre-Ionisation of Analytes and Cluster Analysis in Gradient Micro Liquid Chromatography Electrospray Mass Spectrometry

V. Spikmans, S.J. Lane, B. Leavens, A. Manz, N.W. Smith
Rapid Commun. Mass Spectrom. 16, 1377-1388 (2002)

Microfluidic Routes to the Controlled Production of Nanoparticles

Edel JB, Fortt R, deMello JC, deMello AJ
Chem. Comm. 10, 1136-1137 (2002)

Microchip-Based Synthesis and Total Analysis Systems (µSYNTAS)

M.C. Mitchell, V. Spikmans, A. Manz, A.J. de Mello
J. Chem. Soc. Perkin Trans.1, 2001, 514-518 (2001)

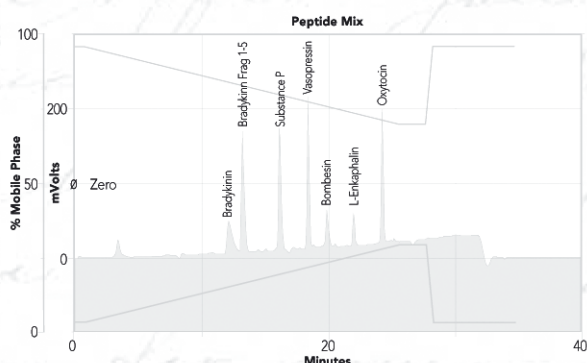
On-line Monitoring of Chromium(III) Using a Fast Micromachined Mixer/Reactor and Chemiluminescence Detection

Y. Xu, F.G. Bessoth, J.C.T. Eijkel, A. Manz
Analyst 125, 677-683 (2000)

Microstructure for Efficient Continuous Flow Mixing

F.G. Bessoth, A.J. de Mello, A. Manz
Anal. Comm. 36, 213-215 (1999)

NanoMixer Gradient Profile:



Retention Time CVs of peptides for 20 injections

Bradykinin: 0.73%
 Bradykinin Frag 1-5: 0.67%
 Substance P: 0.51%
 Vasopressin: 0.66%
 Bombesin: 0.68%
 L-Enkephalin: 0.53%
 Oxytocin: 0.59%

Peptide Chromatographic Conditions

Pump 1: H₂O, 0.1% TFA; 5% IPA
 Pump 2: ACN, 0.1% TFA; 5% IPA
 Gradient: 4% Pump 2 ramped to 30% over 28 minutes.
 Column: 15cm x 0.32mm ID 5µm C5
 Wavelength: 215nm

Data supplied by Gilson®, Inc.

NANOMIXER

		Swept Volume
N-200	NanoMixer for 360µm OD tubing Includes (1) extra V-472-11-3	30 – 60nL
N-200-06	Replacement Mixing Chip	30 – 60nL
V-472-11-3	PEEK NanoFerrules, 3-pk	
M-435-26	Allen Wrench, 3/32" Hex, Balldriver	

NANO FLOW SENSOR

- * Measures flow rate from **-1,000 to +8,000 nL/min**
- * **Directly connects 1/32" OD tubing or smaller with sleeves**
- * **Highly accurate and precise**

Developed by Upchurch Scientific® in cooperation with Honeywell, this non-invasive Nano Flow Sensor yields extremely accurate flow-rate data in the nanoLiter through low microLiter-per-minute range for Analytical, Biotech and Diagnostic instrument applications. Potential uses include:

- Monitoring very low flow rates in HPLC or lab-on-a-chip applications
- Measuring flow for pumps without a flow sensor, including split-stream flow
- Calibrating pumps with or without a built-in flow sensor
- Post-column monitoring of flow going into a detector or post-column reactor
- System troubleshooting – isolating areas of reduced flow, etc.

Using proprietary MEMS-based thermal anemometry technology, this Nano Flow Sensor precisely measures the mass-flow rate of liquids in an isolated flow channel. The sensor features high sensitivity, ultra fast response, high accuracy and low drift in a compact package. Flow rate data is presented on the built-in LED display.



N-565

NEW!

Nano Flow Sensor Specifications:

Operational flow rate range	-1,000nL/min to +8,000nL/min
Precision	±1.5nL/min @ 1,000nL/min
Repeatability	±0.08% of reading per day
Accuracy	>95% typical, depending on calibration accuracy
Update Rate	2Hz
Power Requirements	12Vdc, 100mA
Control	RS-232, 19,200 baud, 8 data bits, 1 stop bit, no parity, no handshaking
Operational Pressure Range	0 – 5,000 psi (0 – 345 bar)
Operational Temperature Range	5-40°C
Wetted Materials	Biocompatible PEEK™ polymer and fused silica
Dead Volume	<1nL
Swept Volume	1µL
Dimensions/Weight	3.7" L x 3.4" W x 1.7" H / 0.45 lbs. (9.4cm x 8.6cm x 4.3cm / 0.20 kg)

Application Note

Don't have a nano-pump? Use Upchurch Scientific fittings to create a split flow for nano- and micro-scale chromatography and the Nano Flow Sensor for reliable feedback.

Select the proper tubing and use a tee to split flow from a standard pump down to nano and micro levels. To select tubing, determine the ratio of flow split that you are trying to achieve and then use Equation 2 below. Pressure and flow are directly proportional in this formula:

$$\text{Equation 1} \quad P = 9.86 \times 10^{-4} \left(\frac{FLV}{d^4} \right)$$

With a constant flow rate and viscosity of tubing, the pressure ratio you receive from the tubing will be equal to the ratio of the lengths of the tubing divided by the ratio of their diameters to the fourth power.

$$\text{Equation 2} \quad \frac{P_1}{P_2} = \frac{L_1}{L_2} \cdot \frac{d_2^4}{d_1^4}$$

For example, if we want P_1 to be 250 times larger than P_2 , we can use the same length of tubing so that the length falls out of the above expression. If we plug in various combinations for the ID of tubing 1 (split flow) and tubing 2 (majority of flow), we find 300µm ID and 75µm ID tubing will make a split of 1:256.

The calculations are tested empirically by setting up a tee split post-column directed to a nano-LC detector (LC Packings UltiMate® Detector, 220nm). The data in Figures 1 and 2 were collected using a Shimadzu LC-10AD pump dispensing an 80% methanol/water mixture at 1.0ml/min. The sample analyzed was a mixture of poly aromatic hydrocarbons dissolved in the mobile phase at a concentration of approximately 0.2µg/ml. The column (Unimicro Daiso ODS-BP 5µm, 120Å, 250 x 4.6mm) was set up after the LC Packings FAMOS autosampler. A P-890 MicroTee was placed immediately after the column. Because the detector has 75cm of 20µm ID tubing integrated, this was plumbed to the split side of the tee. For a 1:1000 split, it was calculated that 15cm of 75µm ID tubing would be appropriate on the waste line. To verify the accuracy and the repeatability of this split tee system, sequential chromatography was performed. The peak flow sensor was placed downstream of the detector to monitor the flow passing from the split side of the tee.

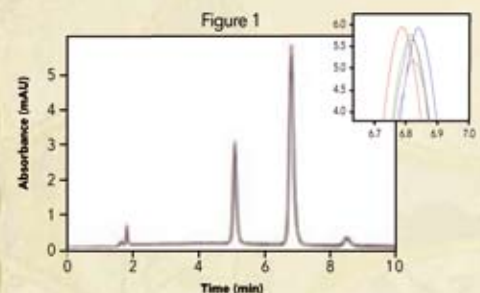


Figure 1: Five overlapped sequential chromatograms with detection post tee splitter.

(Application Notes continued on next page)

NANO FLOW SENSOR (CONT.)

Software and Interface

The Nano Flow Sensor includes easy-to-use Windows® compatible software and communicates with RS-232. The graphical user interface (to the right) displays real-time flow rate information in graphical and numerical format. An easy calibration routine allows the user to calibrate the flow sensor for an unlimited range of solvents. The sensor is delivered precalibrated for aqueous solutions.

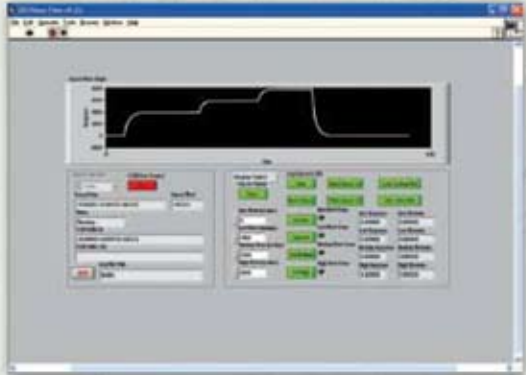
Flow Sensor Performance

The high sensitivity, stability and rapid response of the Nano Flow Sensor make it useful for diagnosing system performance. In the plot shown to the right, the sensor is used to evaluate the output flow response of a developmental nano flow pumping system. This experiment validates the precise flow from the pump. The sensitivity of the Nano Flow Sensor also picks up some overshoot as the flow rate is changed and small fluctuations in flow at higher rates.

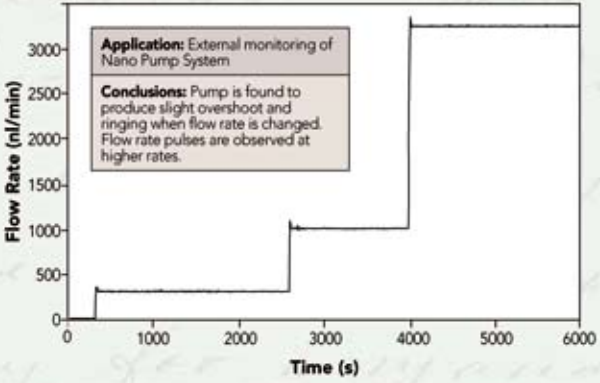
The flow sensor demonstrates extremely stable output at zero flow, indicating the sensor has virtually no drift in flow rate over time. The graph, below right, shows the output from our flow sensor for a period of eight hours with no flow.

We also offer an OEM version for instrument manufacturers that can be easily integrated into an instrument. This version reports data through an RS-232 data stream. Please contact Upchurch Scientific® to learn more about Nano Flow Sensor options for instrument manufacturers.

Software User Interface:



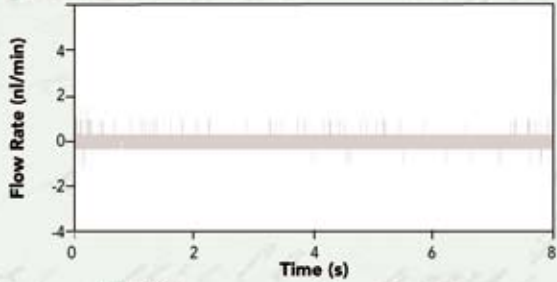
Sensitivity, Stability and Response:



Application: External monitoring of Nano Pump System

Conclusions: Pump is found to produce slight overshoot and ringing when flow rate is changed. Flow rate pulses are observed at higher rates.

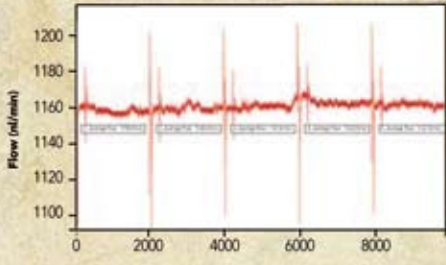
Virtually no Flow-Rate Drift Over Time:



Flow rate zero; stability for 8 hours	Pressure: Atmospheric
Filter: 5-second moving average	Temperature: 35° C regulated
Data: Truncated ±0.5nL/min	RMS noise: <500pL/min
Media: DI Water	

Application Note cont. *

Figure 2



Sensor Data Points (2Hz collection rate)

Figure 2. Flow sensor output during chromatographic runs in Figure 1. Spikes due to injection valve actuation.

The chromatography and output from the flow sensor demonstrate that using the P-890 MicroTee with appropriate sized tubing provides a steady, reliable split from 1.0ml/min to 1.0µl/min. The actual split flow monitored by the sensor is on average 1.16µl/min. The difference in peak retention time on the chromatography is 0.8%. The flow sensor is a useful tool in this application for system information and diagnosis. The position of the sensor downstream of the detector provides information about the flow rate going through the detector, without band broadening due to sensor volume. For any questions concerning using a tee to split flow for nano and micro chromatography, please contact Upchurch Scientific.

NANO FLOW SENSOR

N-565 Nano Flow Sensor for 1/32" OD tubing

REPLACEMENT MICROTIGHT FITTINGS

		Qty.
F-112	MicroFerrule for 1/32" OD tubing, Natural PEEK	ea.
P-116	MicroFerrule Plug, Black PEEK	ea.
P-416BLK	Female Nut, 5/16-24 threads, Natural PEEK	ea.

Each Nano Flow Sensor is shipped with an RS-232 communication cable, a universal AC power cord, software disk and fittings (extra set of ferrules provided).

MICROTIGHT® FITTINGS AND SLEEVES

For Coned Ports

* For Connecting Capillary Tubing

* Made from PEEK™ Polymer

Upchurch Scientific® MicroTight One-Piece Fittings are designed for use with some of our NanoPorts™ and our MicroTight Unions, Adapters and Inline MicroFilters. Specifically made for 360µm OD tubing, 1/32" OD tubing and our MicroTight Tubing Sleeves (discussed below), these fittings make superior fingertight connections with capillary tubing. MicroTight Fittings withstand temperatures up to 125°C.

The MicroTight family also includes a female nut matched with one of five dedicated ferrules for connecting specific tubing ODs:

F-172	70-520µm OD (with MicroTight Tubing Sleeves)
F-152/F-152BLK	360µm OD
F-112	1/32" OD
F-132	1/16" OD

The OD of each MicroTight Tubing Sleeve is .025", with a variety of IDs available to accommodate 70-520µm OD capillary tubing. Choose the tubing sleeve appropriate for the outer diameter of your capillary tubing by referring to the product listings below. Our MicroTight Connector Kit contains all you need to make most basic capillary connections, at a substantial savings over individually purchased components.

Each 1.25" long sleeve will hold tubing to 4,000 psi (276 bar) and can be used at temperatures up to 125°C. MicroTight Fittings that do not require sleeves are rated to 5,000 psi (345 bar).

Use our P-277 Extender Tool to tighten standard head 6-32 fittings in hard-to-reach places. Tighten headless 6-32 fittings with our N-290 Tool.

Note

these ferrules are not interchangeable, and must be used with the products for which they are designed.



MICROTIGHT FITTINGS

		Qty.
F-112	MicroFerrule for 1/32" OD tubing, Natural PEEK	ea.
F-124Hx	Headless Fittings for 360µm OD tubing, 6-32, Blue PEEK	10-pk
F-124Sx	Std. Head Fittings for 360µm OD tubing, 6-32, Blue PEEK	10-pk
F-125x	Std. Head Fittings for MicroTight Sleeves, 6-32, Natural PEEK	10-pk
F-125Hx	Headless Fittings for MicroTight Sleeves, 6-32, Natural PEEK	10-pk
F-126Hx	Headless Fittings for 1/32" OD tubing, 6-32, Red PEEK	10-pk
F-126Sx	Std. Head Fittings for 1/32" OD tubing, 6-32, Red PEEK	10-pk
F-132	MicroFerrule for 1/16" OD tubing, Natural PEEK	ea.
F-152	MicroFerrule for 360µm OD tubing, Natural PEEK	ea.
F-152BLK	MicroFerrule for 360µm OD tubing, Black PEEK	ea.
F-172	MicroFerrule for .025" OD tubing, Black PEEK	ea.
N-290	Extender Tool for Headless 6-32 Fittings	ea.
P-116	MicroFerrule Plug, Black PEEK ¹	ea.
P-277	Extender Tool for Standard Head 6-32 Fittings	ea.
P-416	Female Nut, 5/16-24 internal threads, Natural PEEK ²	ea.
P-416BLK	Female Nut, 5/16-24 internal threads, Black PEEK ²	ea.
P-416G	Female Nut, 5/16-24 internal threads, Green PEEK ²	ea.
P-555	Std. Head Plug, 6-32, Natural PEEK ³	ea.

MICROTIGHT PEEK TUBING SLEEVES AND KITS, .025" OD

	ID	For Tubing OD Size	Color	Qty.
F-180x	125µm (.005")	70 - 110µm	Red	10-pk
F-181x	180µm (.007")	125 - 165µm	Yellow	10-pk
F-182x	230µm (.009")	175 - 215µm	Natural	10-pk
F-183x	280µm (.011")	225 - 265µm	Blue	10-pk
F-184x	330µm (.013")	275 - 315µm	Orange	10-pk
F-185x	395µm (.0155")	340 - 380µm	Green	10-pk
F-186x	455µm (.018")	400 - 440µm	Black	10-pk
F-187x	535µm (.021")	480 - 520µm	Natural	10-pk
F-188x	152µm (.006")	95 - 135µm	Purple	10-pk
1328	MicroTight Tubing Sleeve Kit contains (6) each of the sleeve sizes listed above			
1356	MicroTight Connector Kit Kit contains: a 10-pack of each MicroTight Tubing Sleeve (F-180 - F-187); (2) P-770 MicroTight Adapters; and (2) MicroTight P-720 Unions			

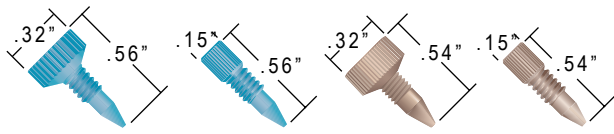
¹ Can only be used with products designed to use the F-152 and F-172 Ferrule.

² Can be used with F-112, F-132, F-152, F-152BLK, F-172 or P-116.

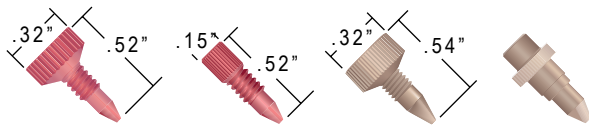
³ Can be used to plug any of our 6-32 threaded ports.



MICROTIGHT® FITTINGS (CONT.)



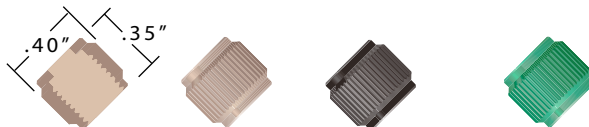
F-124S Standard Head Fitting for use with 360µm OD tubing
F-124H Headless Fitting for use with 360µm OD tubing
F-125 Standard Head Fitting for use with MicroTight Sleeves
F-125H Headless Fitting for use with MicroTight Sleeves



F-126S Standard Head Fitting for use with 1/32" OD tubing
F-126H Headless Fitting for use with 1/32" OD tubing
P-555 Standard Head Plug
F-112 MicroFerrule for 1/32" OD tubing



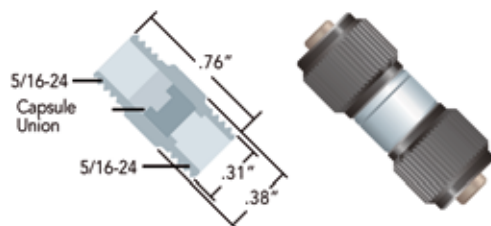
F-132 MicroFerrule for 1/16" OD tubing
F-152 MicroFerrule for 360µm OD tubing
F-172 MicroFerrule for .025" OD tubing
P-116 MicroFerrule Plug



P-416 Female Nut 5/16-24 internal threads
P-416BLK Female Nut 5/16-24 internal threads
P-416G Female Nut 5/16-24 internal threads

CONDUCTIVE MICROTIGHT UNION

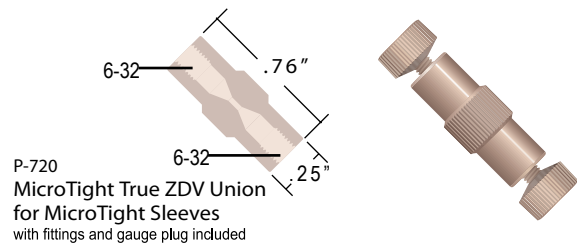
The Conductive MicroTight Union now available from Upchurch Scientific® provides an excellent opportunity to introduce voltage into an electrospray or capillary electrophoresis system. With an extremely low internal volume of 16nL, the union can be placed inline with 360µm OD capillary tubing. Mount and apply voltage to this union using our Insulating Mounting Bracket.



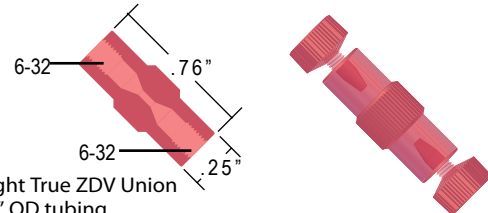
M-572 Conductive MicroTight Union for 360µm OD tubing with fittings and Capsule Union included

MICROTIGHT UNIONS

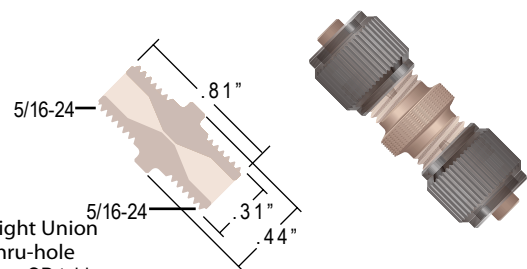
Connect two pieces of capillary tubing with these Upchurch Scientific® PEEK™ MicroTight Unions. Choose from our selection of MicroTight Tubing Sleeves to use with the true zero dead volume (ZDV) P-720 Union. The P-771 True ZDV Union allows direct connection of 1/32" OD tubing without sleeves. The True ZDV Unions allow two pieces of tubing to connect directly to each other — using the included gauge plug to ensure proper alignment (also applies to MicroTight Adapters). Our P-772 Union direct connects popular 360µm OD capillary tubing without sleeves, adding only 5nL of swept volume with its .006" (150µm) thru-hole.



P-720 MicroTight True ZDV Union for MicroTight Sleeves with fittings and gauge plug included



P-771 MicroTight True ZDV Union for 1/32" OD tubing with fittings and gauge plug included



P-772 MicroTight Union .006" thru-hole for 360µm OD tubing with fittings included

Please Note: the above products that require MicroTight Sleeves to connect tubing are pressure rated to 4,000 psi (276 bar). Those designed to directconnect tubing without sleeves are pressure rated to 5,000 psi (345 bar).

MICRO STATIC MIXING TEE

	Thru-hole	Swept Volume
M-540 Micro Static Mixing Tee** , for 1/16" OD tubing	.010" (.25mm)	.95µL*
Includes (3) F-132 and (3) P-416 Fittings		

CONDUCTIVE PERFLUOROELASTOMER FERRULE

	Qty.
M-215 Conductive Perfluoroelastomer Ferrule , Black For 360µm OD Tubing	ea.

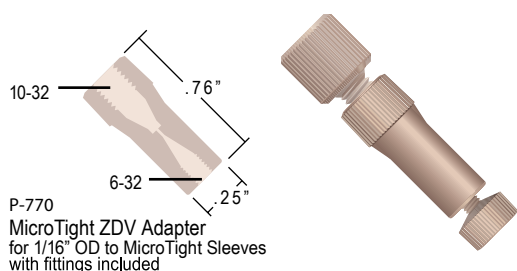
* Includes frit volume

** The frit in this product cannot be changed.

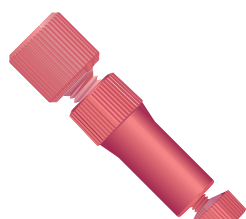
MICROTIGHT® ADAPTERS

Create a true zero dead volume (ZDV) connection between 1/16" OD tubing and capillary tubing with these Upchurch Scientific® PEEK™ MicroTight Adapters. P-770 connects 1/16" OD tubing to a variety of capillary tubing sizes using MicroTight Tubing Sleeves. Our P-881 and P-882 Adapters allow connection of 1/16" OD tubing directly to 1/32" OD and 360µm tubing, respectively.

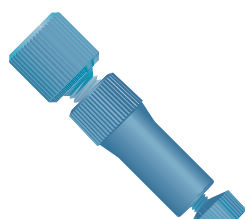
Please Note: use only the 6-32 threaded fitting supplied with each adapter — they are not interchangeable. Replacement 6-32 fittings. Replacement F-120 style nuts (when ordering, replace the "x" with a "R" or "B" to order red or blue fittings, respectively).



P-770
MicroTight ZDV Adapter
for 1/16" OD to MicroTight Sleeves
with fittings included



P-881
MicroTight ZDV Adapter
for 1/16" to 1/32" OD tubing
with fittings included



P-882
MicroTight ZDV Adapter
for 1/16" to 360µm OD tubing
with fittings included

Please Note: the above products that require MicroTight Sleeves to connect tubing are pressure rated to 4,000 psi (276 bar). Those designed to direct-connect tubing without sleeves are pressure rated to 5,000 psi (345 bar).

More Micro Flow Products:

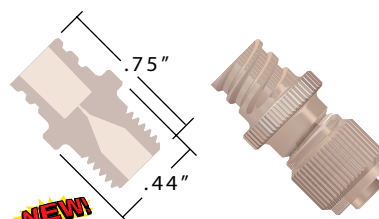
Use this list to find micro flow products outside this chapter.

	Page
Two-Piece Fingertights for capillary tubing and Conductive Perfluoroelastomer Ferrule	14
Fittings for 1/32" OD Tubing	14, 16, 19
360µm, 510µm (.020") and 1/32" OD PEEK Tubing	67
360µm OD Fused Silica Tubing	67
1/16" and 1/32" OD PEEKsil™ Tubing	68
1/32" OD Teflon® FEP Tubing	71
360µm OD High Purity Teflon PFA Tubing	72
510µm (.020") and 1/32" OD Stainless Steel Tubing	74 – 75
Polymer Capillary and Fused Silica Tubing Cutters	76 – 77
Rheodyne® MX Module Micro-Scale Injector and Switching Valves	79 – 82
Rheodyne Manual Micro-Scale Injectors	85
Micro Injection Port Adapters	97
Micro-Splitter Valves	104
Micro-Metering Valves	105
Ultra-Low Volume Back-Pressure Regulators	110
Nonmetallic 10-32 Micro-Volume Inline Check Valve	112
Microbore Guard Column	133
ISMATEC® Peristaltic Tubing Pumps	136 – 140
Sapphire Engineering™ PVMs/IPVs	144 – 146

LUER-TO-MICROTIGHT ADAPTER

The new Upchurch Scientific Luer-to-Microtight Adapter is ideal for infusing sample into lab-on-a-chip devices. This product is made entirely of biocompatible PEEK polymer and introduces no dead volume to the flow path. Use it to directly connect a luer-tip syringe or other standard male luer to 360µm OD capillary tubing without tubing sleeves (see photo). MicroTight Fittings are included.

P-662 Luer-to-MicroTight Adapter, shown with a B-310 Syringe and PEEK capillary tubing, not included.



P-662
Luer-To-MicroTight Adapter
for Luer to 360µm OD tubing
with fittings included

MICROTEE, MICROCROSS AND MICROELBOW

		Swept Volume
P-775	MicroTee for MicroTight Sleeves Includes (3) F-172 and (3) P-416 Fittings	29nL
P-777	MicroCross for MicroTight Sleeves Includes (4) F-172 and (4) P-416 Fittings	38nL
P-874	MicroElbow with Mounting Hole, for MicroTight Sleeves Includes (2) F-172 and (2) P-416 Fittings	20nL
P-875	MicroTee with Mounting Hole, for MicroTight Sleeves Includes (3) F-172 and (3) P-416 Fittings	29nL
P-885	MicroTee for 1/32" OD tubing Includes (3) F-112 and (3) P-416 Fittings	29nL
P-887	MicroCross for 1/32" OD tubing Includes (4) F-112 and (4) P-416 Fittings	38nL
P-888	MicroTee for 360µm OD tubing Includes (3) F-152 and (3) P-416BLK Fittings	29nL
P-889	MicroCross for 360µm OD tubing Includes (4) F-152 and (4) P-416BLK Fittings	38nL
P-890	MicroTee for 1/16" OD tubing Includes (3) F-132 and (3) P-416 Fittings	58nL
P-891	MicroCross for 1/16" OD tubing Includes (4) F-132 and (4) P-416 Fittings	81nL



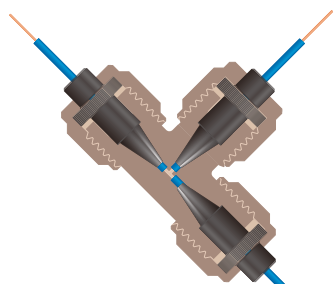
MICROTEE, CROSS AND ELBOW

- * Direct Connect 1/16", 1/32", 360µm OD Tubing, plus other Capillary Tubing
- * Low Swept Volume

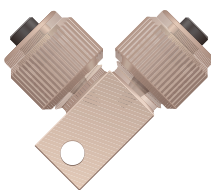
Use Upchurch Scientific® MicroTees, MicroCrosses or MicroElbow to join capillary tubing. All of these products are made entirely of PEEK™ and have .006" (150µm) thru-holes, with resulting swept volumes ranging from 20 to 81 nL.

Several of these products are designed to connect capillary tubing of various ODs, using our MicroTight® Tubing Sleeves. Versions for direct connecting 1/16", 1/32" and 360µm OD tubing are also available. In addition, the MicroElbow and one version of the MicroTee come with convenient predrilled 13" (3.3mm) mounting holes.

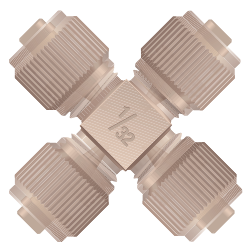
Please Note: use only the ferrules supplied with each connector — they are not interchangeable. Replacement ferrules and female nuts are available.



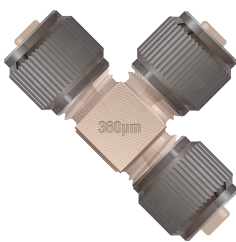
P-775
MicroTee for MicroTight Tubing Sleeves
.006" thru-holes
with fittings included
(tubing sleeves not included)



P-874
MicroElbow for MicroTight Tubing Sleeves
.006" thru-holes
with fittings included



P-887
MicroCross
for 1/32" OD tubing
.006" thru-holes
with fittings included



P-888
MicroTee
for 360µm OD tubing
.006" thru-holes
with fittings included



NEW
P-890
MicroTee
for 1/16" OD tubing
.006" thru-holes
with fittings included

Note

Several researchers use our PEEK MicroTee to introduce ionizing voltage to their fluid stream just prior to a Mass Spectrometer¹. MicroTees are well suited for this application due to advantageous internal geometry and PEEK polymer's electrical resistance. The materials required for this setup are as follows: one gold or platinum conducting wire, one P-775 or P-875 MicroTee (this page), one MicroTight Tubing Sleeve for the conducting wire (as needed to accommodate wire diameter), and at least two more MicroTight Tubing Sleeves to connect your capillary tubing.

Connect the wire to the center port of the MicroTee.

First, thread your wire through the appropriate tubing sleeve, if necessary, with the wire extending beyond both ends of the sleeve. Slip the female nut included with the MicroTee over the wire or sleeved wire, followed by the ferrule — ensuring the wire (and its sleeve) extends well past the end of the ferrule tip. Align the tip of the wire with the thru-hole of the MicroTee and gently insert the wire until it bottoms out. Now finger tighten the female nut into place. Attach your flow path tubing to the MicroTee's two other available ports, following the instructions provided with the MicroTee.

Begin fluid flow through the tee and apply voltage to the conducting wire lead. This setup typically provides effective electrospray ionization in applications having a flow rate of 100µL/min or greater.

¹ One such paper describing pioneering electrospray work: Protein Identification at the Low Femtomole Level from Silver-Stained Gels Using a New Fritless Electrospray Interface for Liquid Chromatography-Microspray and Nanospray Mass Spectrometry. Christine L. Gattin, Gerd R. Kleemann, Lara G. Hays, Andrew J. Link, John R. Yates III (1998) Analytical Biochemistry 263, 93-101.

Please Note: the MicroTees, Crosses and Elbows that require MicroTight Sleeves to connect tubing are pressure rated to 4,000 psi (276 bar). Those designed to direct-connect tubing without sleeves are pressure rated to 5,000 psi (345 bar).

MICROTEE, MICROCROSS AND MICROELBOW

		Swept Volume
P-775	MicroTee for MicroTight Sleeves Includes (3) F-172 and (3) P-416 Fittings	29nL
P-777	MicroCross for MicroTight Sleeves Includes (4) F-172 and (4) P-416 Fittings	38nL
P-874	MicroElbow with Mounting Hole, for MicroTight Sleeves Includes (2) F-172 and (2) P-416 Fittings	20nL
P-875	MicroTee with Mounting Hole, for MicroTight Sleeves Includes (3) F-172 and (3) P-416 Fittings	29nL
P-885	MicroTee for 1/32" OD tubing Includes (3) F-112 and (3) P-416 Fittings	29nL
P-887	MicroCross for 1/32" OD tubing Includes (4) F-112 and (4) P-416 Fittings	38nL
P-888	MicroTee for 360µm OD tubing Includes (3) F-152 and (3) P-416BLK Fittings	29nL
P-889	MicroCross for 360µm OD tubing Includes (4) F-152 and (4) P-416BLK Fittings	38nL
P-890	MicroTee for 1/16" OD tubing Includes (3) F-132 and (3) P-416 Fittings	58nL
P-891	MicroCross for 1/16" OD tubing Includes (4) F-132 and (4) P-416 Fittings	81nL

NANOPORT™ ASSEMBLIES

* For Lab-on-a-Chip Applications

Upchurch Scientific® NanoPort Assemblies are the first commercially available products to provide consistent fluid connections for chip-based analyses. These patent-pending products bond easily to chip surfaces with the provided Preformed Adhesive Rings or with alternative Epoxy Adhesive (see Application Note below). Once attached, NanoPort connections withstand pressures to 1,500 psi (103 bar).* NanoPorts will adhere to silicon, quartz, glass and polymers and will handle 1.5 – 6.0 in-lbs. (0.17 N-m to 0.68 N-m) of torque, depending on the substrate (typical fittings require only 0.25 – 0.50 in-lbs. to tighten).

All NanoPort components are made of inert, biocompatible PEEK™ polymer (nuts and ports) and Perlast® perfluoroelastomer (ferrules and gaskets). Their unique design also prevents adhesive contamination of the fluid path. And NanoPort connections add no additional volume to the fluid path, eliminating dead volume traditionally associated with chip-based fluid connections.

Choose from several options to direct-connect 360µm, 1/32" and 1/16" OD tubing. Or use our N-125H or N-125S with a MicroTight™ Tubing Sleeve to connect capillary tubing with ODs of 70 – 520µm. Our NanoPort Reservoir Assembly is designed for open well applications, such as CE.

To select the appropriate NanoPort assembly you will need to consider:

1. Size of tubing you are connecting
2. Dimensions of the chip hole
3. Fitting style (one-piece or two-piece fittings)
4. Nut head style (standard or headless nut)

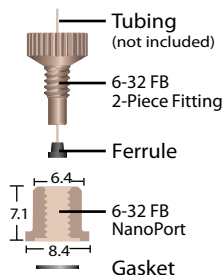
Please Note: each NanoPort Assembly includes a fitting (one- or two-piece), a NanoPort, gasket, a 2-pack of preformed adhesive rings, and a clamp for holding the port in place while the adhesive cures.

Custom NanoPort component configurations are available to Original Equipment Manufacturers (OEMs), including multiport manifolds, alternative thermoplastic materials, special component sizing and specific reservoir volumes. Please contact Upchurch Scientific for more information.

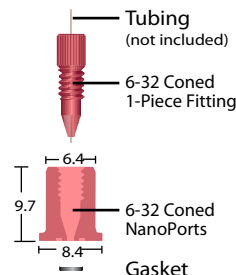
*Except the N-333 NanoPort Assembly, which is rated to 500 psi (34.5 bar).

Please Note: All measurements below are in mm.

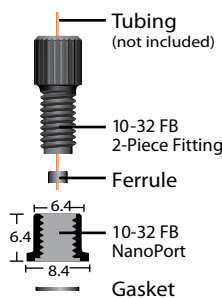
6-32 Flat-Bottom Assemblies



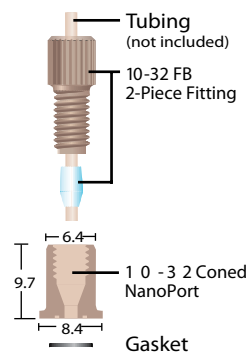
6-32 Coned Assemblies



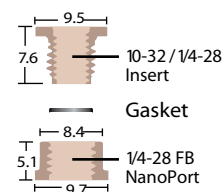
10-32 Flat-Bottom Assemblies



10-32 Coned Assembly



Reservoir Assembly



Application Note

NanoPort Reservoir Applications:

- >> Sample reservoir
- >> Open wells for capillary electrophoresis
- >> Syringe injection or flushing/priming, using our P-604 Luer Adapter and luer syringe (such as our B-310)

NANOPORT™ ASSEMBLIES (CONT.)



Application Note

NanoPort Adhesive Cure Requirements

* Preformed Adhesive Rings (included with each order)

Cure Temperature	Cure Time
250°F/121°C	95 Minutes
275°F/135°C	42 Minutes
300°F/149°C	20 Minutes
325°F/163°C	12 Minutes

* Alternative Epoxy Adhesive (N-008):
Room temperature cure for 24 hours,
or cure at 120°F (49°C) for one hour.

* Please contact us regarding adherence
to specific polymer substrates and other
adhesive options.

EXTENDER TOOLS

Upchurch Scientific® offers Extender Tools to make it easier to tighten fittings which would otherwise be too close for adequate finger tightening. The special design of these tools allows tightening without damaging a nut's knurled head. Use our P-277 Extender Tool to tighten standard head 6-32 fittings. The N-290 Extender Tool is designed for tightening headless 6-32 and 6-40 fittings. Tighten headless 10-32 fittings with our P-297 Extender Tool.



NANOPORT ASSEMBLIES

Please refer to footnote 1, below, for abbreviation definitions.

Nut	Ferrule	For Chip Hole (dia. x depth)	For Tubing OD
6-32 Flat-Bottom NanoPort Assemblies*			
N-121H	F-123H Hdls.	N-123-04	1mm x 1mm 360µm
N-121S	F-123S Std.	N-123-04	1mm x 1mm 360µm
N-122H	F-123H Hdls.	N-123-05	1mm x 1.5mm 360µm
N-122S	F-123S Std.	N-123-05	1mm x 1.5mm 360µm
N-123H	F-123H Hdls.	N-123-03	1mm dia. or less 360µm
N-123S	F-123S Std.	N-123-03	1mm dia. or less 360µm
6-32 Coned NanoPort Assemblies*			
N-124H	F-124H Hdls.	None	Up to 1/16" 360µm
N-124S	F-124S Std.	None	Up to 1/16" 360µm
N-125H	F-125H Hdls.	None	Up to 1/16" 70 - 520µm ²
N-125S	F-125 Std.	None	Up to 1/16" 70 - 520µm ²
N-126H	F-126H Hdls.	None	Up to 1/16" 1/32"
N-126S	F-126S Std.	None	Up to 1/16" 1/32"
10-32 Flat-Bottom NanoPort Assemblies*			
N-128H	F-121H	N-127-03	1mm dia. or less 1/32"
N-129H	F-122H	N-123-04	1mm x 1mm 360µm
N-130H	F-122H	N-123-05	1mm x 1.5mm 360µm
10-32 Coned NanoPort Assembly*			
N-333	F-333N	F-142N	Up to 1/16" 1/16"
NanoPort Reservoir Assembly**			
N-131	80µL Reservoir with Insert		

NANOPORT REPLACEMENT PARTS

Product	For Port	For Chip Hole (dia. x depth)	For Tubing OD	Qty.
Fittings				
F-121Hx	Headless Nuts	10-32 FB	n/a	360µm, 1/32" 10-pk
F-122Hx	Headless Nuts	10-32 FB	n/a	360µm 10-pk
F-123Hx	Headless Nuts	6-32 FB	n/a	360µm 10-pk
F-123Sx	Std. Head Nuts	6-32 FB	n/a	360µm 10-pk
F-124Hx	Headless Nuts	6-32 Coned	n/a	360µm 10-pk
F-124Sx	Std. Head Nuts	6-32 Coned	n/a	360µm 10-pk
F-125Hx	Headless Nuts	6-32 Coned	n/a	70 - 520µm ² 10-pk
F-125x	Std. Head Nuts	6-32 Coned	n/a	70 - 520µm ² 10-pk
F-126Hx	Headless Nuts	6-32 Coned	n/a	1/32" 10-pk
F-126Sx	Std. Head Nuts	6-32 Coned	n/a	1/32" 10-pk
F-333Nx	Hdls. Nuts/Ferrules	10-32 Coned	Up to 1/16"	1/16" 10-pk
F-142Nx	Ferrules	10-32 Coned	Up to 1/16"	1/16" 10-pk
N-123-03x	Ferrules	6-32 FB	1mm dia. or less	360µm 10-pk
N-123-04x	Ferrules	6-32, 10-32 FB	1mm x 1mm	360µm 10-pk
N-123-05x	Ferrules	6-32 FB	1mm x 1.5mm	360µm 10-pk
N-127-03x	Ferrules	10-32 FB	1mm or less	1/32" 10-pk
Gaskets				
N-123-02	Gasket ,	For all assemblies except 6-32 Coned Assemblies		ea.
N-124-02	Gasket ,	For 6-32 Coned Assemblies		ea.
Adhesives and Clamp				
N-006	Clamp			ea.
N-008	Alternative Epoxy Adhesive, Single Use			3gm
N-100-01	Preformed Adhesive Rings			2-pk

EXTENDER TOOLS

Product	For	Qty.
N-290	For Headless 6-32 (and 6-40) Fittings	ea.
P-277	For Standard Head 6-32 Fittings	ea.
P-297	For Headless 10-32 Fittings	ea.

¹ Abbreviation Definitions: dia. = Diameter; Std. = Standard; Hdls = Headless; FB = Flat-Bottom; n/a = Not Applicable

² Designed to use our MicroTight® Tubing Sleeves (page 28) to connect tubing OD sizes from 70-520µm. Except as noted, each NanoPort Assembly includes (1) nut; (1) ferrule; (1) NanoPort; (1) gasket;

* (1) N-100-01 Preformed Adhesive Rings (2-pack); and (1) N-006 Clamp.

** Includes (1) Reservoir NanoPort; (1) Insert; (1) N-123-02 Gasket; (1) N-100-01 Preformed Adhesive Rings (2-pack); and (1) N-006 Clamp.

MINI MICROFILTERS

* **Total Volume as Low as 10nL!**

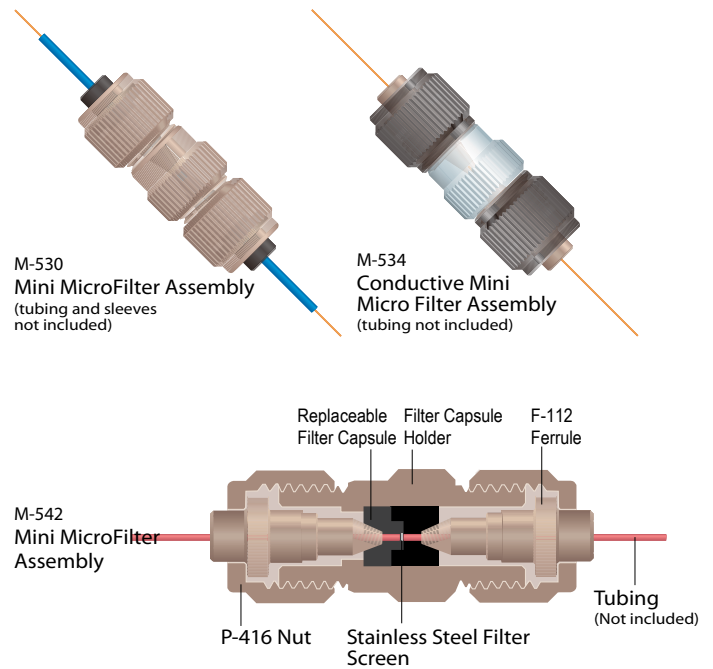
* **Conductive Version for CEC and Mass Spectrometry Applications**

Upchurch Scientific® Mini MicroFilter Assemblies filter effectively with internal volumes low enough to ensure reliable chromatographic results — even at nanoliter flow rates! They achieve this using 1µm and 2µm porosity replaceable filter capsules — some versions with a thin, stainless steel micro screen (0.25mm thick x 1mm diameter) and others with a miniscule sintered stainless steel (SST) or titanium (Ti) frit disc (0.25mm thick x 0.5mm diameter). At these sizes, the filtration micro-screen and discs are just a little bigger than the diameter of the period at the end of this sentence. Internal volumes of these encapsulated filters are as low as 85nL with the micro-screen and 10nL to 22nL with the frit disc option!

The micro-screen filter capsules have versions designed for connecting capillary tubing (70-520µm OD) in combination with our MicroTight® Tubing Sleeves, or for direct connecting 360µm and 1/32" (790µm) OD tubing. The frit-disc filter capsules (NanoFilters) are only available for versions that directly connect 360µm and 1/32" OD tubing. The fittings supplied with each MicroFilter are not interchangeable.

Apply voltage to the stainless steel filter holder body of the Conductive Mini MicroFilter for applications such as mass spectrometry and CEC analysis. The voltage is conducted through to the stainless steel portion of the 1µm NanoFilter Capsule and on to the fluid stream. Try our Insulating Mounting Bracket to apply voltage easily.

Please Note: the MiniFilters that require MicroTight Tubing Sleeves to connect tubing are pressure rated to 4,000 psi (276 bar). Those designed to directconnect tubing without sleeves are pressure rated to 5,000 psi (345 bar).



MINI MICROFILTER ASSEMBLY

For use with MicroTight Tubing Sleeves (page 28) for capillary tubing

M-530 2µm Mini MicroFilter Assembly, SST Screen
Includes (5) 2µm M-122 Filter Capsules, (2) F-172 and (2) P-416 Fittings

M-531 1µm Mini MicroFilter Assembly, SST Screen
Includes (5) 1µm M-121 Filter Capsules, (2) F-172 and (2) P-416 Fittings

For direct-connect use of 360µm OD capillary tubing

M-532 2µm Mini MicroFilter Assembly, SST Screen
Includes (5) 2µm M-124 Filter Capsules, (2) F-152 and (2) P-416BLK Fittings

M-533 1µm Mini MicroFilter Assembly, SST Screen
Includes (5) 1µm M-123 Filter Capsules, (2) F-152 and (2) P-416BLK Fittings

M-537 1µm Mini MicroFilter Assembly, SST Frit
Includes (5) 1µm M-125 NanoFilter™ Capsules, (2) F-152 and (2) P-416BLK Fittings

M-538 1µm Mini MicroFilter Assembly, Ti Frit
Includes (5) 1µm M-126 NanoFilter Capsules, (2) F-152 and (2) P-416BLK Fittings

For direct-connect use of 1/32" OD tubing

M-542 2µm Mini MicroFilter Assembly, SST Screen
Includes (5) 2µm M-132 Filter Capsules, (2) F-112 and (2) P-416 Fittings

M-543 1µm Mini MicroFilter Assembly, SST Screen
Includes (5) 1µm M-131 Filter Capsules, (2) F-112 and (2) P-416 Fittings

M-547 1µm Mini MicroFilter Assembly, SST Frit
Includes (5) 1µm M-133 NanoFilter Capsules, (2) F-112 and (2) P-416 Fittings

M-548 1µm Mini MicroFilter Assembly, Ti Frit
Includes (5) 1µm M-134 NanoFilter Capsules, (2) F-112 and (2) P-416 Fittings

Conductive, for direct-connect use with 360µm OD tubing

M-534 1µm Conductive Mini MicroFilter Assembly, SST Frit
Includes (5) 1µm M-128 NanoFilter Capsules, (2) F-152 and (2) P-416BLK Fittings

REPLACEMENT MINI MICROFILTER CAPSULES*

For use with M-530 and M-531

M-121 1µm Filter Capsule, PEEK™ with SST filter screen 2-pk

M-122 2µm Filter Capsule, PEEK with SST filter screen 2-pk

For use with M-532 and M-533

M-123 1µm Filter Capsule, PEEK with SST filter screen 2-pk

M-124 2µm Filter Capsule, PEEK with SST filter screen 2-pk

For use with M-537 and M-538

M-125 1µm NanoFilter Capsule, PEEK with SST frit 2-pk

M-126 1µm NanoFilter Capsule, PEEK with Ti frit 2-pk

For use with M-542 and M-543

M-131 1µm Filter Capsule, PEEK with SST filter screen 2-pk

M-132 2µm Filter Capsule, PEEK with SST filter screen 2-pk

For use with M-547 and M-548

M-133 1µm NanoFilter Capsule, PEEK with SST frit 2-pk

M-134 1µm NanoFilter Capsule, PEEK with Ti frit 2-pk

Conductive, For use with M-534

M-128 1µm Conductive NanoFilter Capsule, SST/PEEK with SST Frit 2-pk

SST = Stainless Steel; Ti = Titanium

*See color coding of these capsules to the left.

Mini MicroFilters Components:

Mini MicroFilter Assembly	Filter Capsule	Porosity	Frit Material	Fittings ¹	For use with Tubing OD Size	Volume
M-530	M-122	2µm	SST Screen	F-172, P-416	70-520µm ²	85nL
M-531	M-121	1µm	SST Screen	F-172, P-416	70-520µm ²	85nL
M-532	M-124	2µm	SST Screen	F-152, P-416BLK	360µm	85nL
M-533	M-123	1µm	SST Screen	F-152, P-416BLK	360µm	85nL
M-534	M-128	1µm	SST Frit	F-152, P-416BLK	360µm	10nL
M-537	M-125	1µm	SST Frit	F-152, P-416BLK	360µm	10nL
M-538	M-126	1µm	Ti Frit	F-152, P-416BLK	360µm	10nL
M-542	M-132	2µm	SST Screen	F-112, P-416	1/32" (790µm)	97nL
M-543	M-131	1µm	SST Screen	F-112, P-416	1/32" (790µm)	97nL
M-547	M-133	1µm	SST Frit	F-112, P-416	1/32" (790µm)	22nL
M-548	M-134	1µm	Ti Frit	F-112, P-416	1/32" (790µm)	22nL

¹ Replacement fittings are listed on page 28.
² Using MicroTight Tubing Sleeves (page 28).

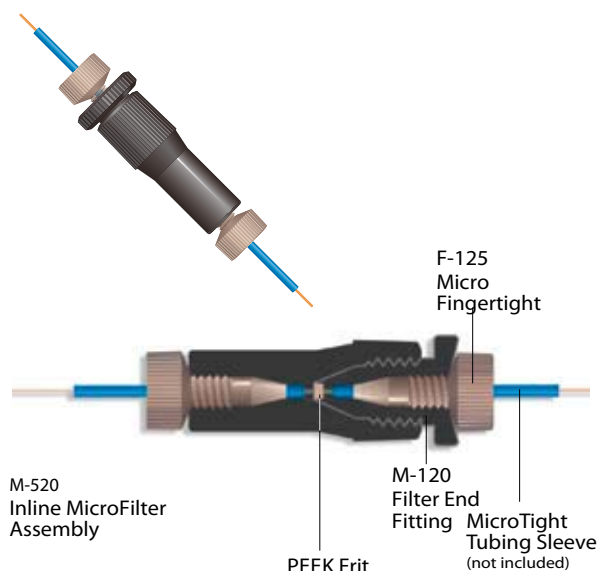
Filter Capsule Color Identification



INLINE MICROFILTERS

- * 100% Biocompatible PEEK™ Polymer Option Available
- * As Low as 109nL Void Volume

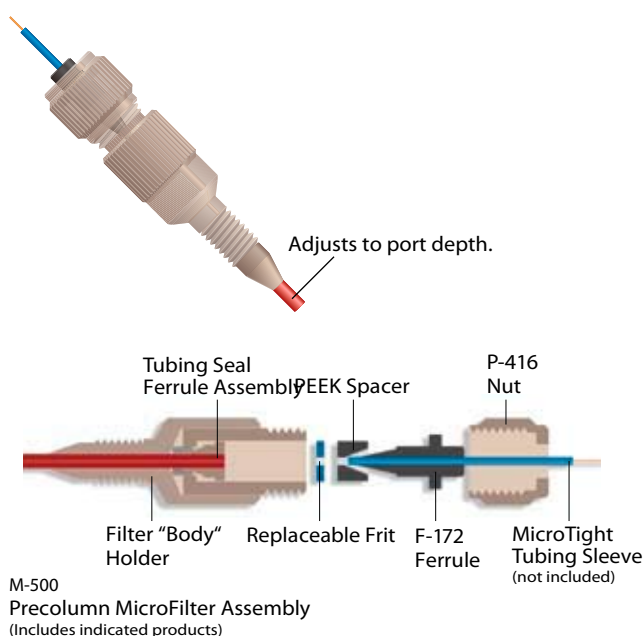
Upchurch Scientific® Inline MicroFilters protect your column from particles originating in the mobile phase or sample, or from pump seal and sample injection valve wear. These filters have a .006" (150µm) thru-hole, and come complete with five PEEK polymer end fittings, each containing a filtering frit. Choose the M-520 with a 0.5µm 100% PEEK frit or the M-135 1.0µm stainless steel filtering screen version, with total theoretical void volumes of 240nL and 109nL, respectively (please see the Mini MicroFilter for more information regarding the micro screen incorporated into the M-135). Also included are two F-125 Micro Fingertight Fittings, designed to work with our MicroTight® Tubing Sleeves and capillary 70-520µm OD tubing. Replacement PEEK Filter End Fittings are available in 10 packs. These filters are pressure rated to 4,000 psi (276 bar).



PRECOLUMN MICROFILTERS

- * Direct Connects to Most Columns with 10-32 Threads
- * Total Void Volume of 0.5µL

These Precolumn MicroFilters have 10-32 standard male threads for direct connecting into your microbore or analytical column. Total theoretical void volume is only 0.5µL (includes frit volume) and the PEEK tubing used in the assembly of these units has a .005" (125µm) ID, virtually eliminating any mixing. Two types of filter assemblies are available: one for standard 1/16" OD tubing, the other for 70-520µm OD capillary tubing using our MicroTight Tubing Sleeves. Each Upchurch Scientific MicroFilter Assembly comes complete with 0.5µm replacement stainless steel or PEEK frits, and is pressure rated to 4,000 psi (276 bar).



Application Note

The Mini MicroFilter and InlineMicroFilter can be used to pack capillary tubing.

Simply place one of these filters on the effluent side of the apillary tubing, then slurry pack. Once packed, place a filter at the head of the tubing. This creates a reliable capillary column without fusing the silica to make frits or pressing filter paper inside the capillary tubing.

Note

The components of M-500 and M-510 Precolumn MicroFilters are not interchangeable with those of M-550 and M-560 versions. The components are specific to the OD of the tubing used.

INLINE MICROFILTERS

For use with MicroTight Tubing Sleeves (page 28) for capillary tubing

M-520	0.5µm Inline MicroFilter Assembly, PEEK Frit Includes (5) 0.5µm M-120 MicroFilter End Fittings and (2) F-125 Fittings
M-135	1.0µm Inline MicroFilter Assembly, SST Screen Includes (5) 1.0µm M-130 MicroFilter End Fittings and (2) F-125 Fittings

REPLACEMENT INLINE MICROFILTER END-FITTINGS

		Qty.
M-120x	End-Fittings, Black, with 0.5µm PEEK Frit	10-pk
M-130x	End-Fittings, Natural, with 1.0µm SST Filter Screen	10-pk

PRECOLUMN MICROFILTER ASSEMBLIES

For use with MicroTight Tubing Sleeves (page 28) for capillary tubing

M-500	0.5µm Precolumn MicroFilter Assembly, SST Frit Includes (5) 0.5µm C-425 Frits, (1) F-172 and (1) P-416 Fitting
M-510	0.5µm Precolumn MicroFilter Assembly, PEEK Frit Includes (5) 0.5µm A-735 Frits, (1) F-172 Ferrule and (1) P-416 Fitting

For use with 1/16" OD tubing

M-550	0.5µm Precolumn MicroFilter Assembly, SST Frit Includes (5) 0.5µm C-425 Frits, (1) F-132 Ferrule and (1) P-416 Fitting
M-560	0.5µm Precolumn MicroFilter Assembly, PEEK Frit Includes (5) 0.5µm A-735 Frits, (1) F-132 Ferrule and (1) P-416 Fitting

Replacement Precolumn MicroFilter Frits		Porosity	Qty.
A-735x	PEEK Frits, .045" x .031" x .192"	0.5µm	10-pk
C-420x	SST Frits, .038" x .028" x .192"	2.0µm	10-pk
C-425x	SST Frits, .038" x .028" x .192"	0.5µm	10-pk

SST = Stainless Steel

CAPILLARY SAMPLE TRAP COLUMNS

- * Optimized for Protein and Peptide Separation/Purification
- * Nonconductive and Conductive Options
- * Packed and Unpacked Columns

Upchurch Scientific® Capillary Sample Trap Columns are ideal for separating and concentrating and/or purifying biological samples. The heart of the Sample Trap is a fused silica capillary column. Available prepackaged capillary columns include: reversed-phase C18, high-carbon load, 5µm/300Å spherical silica, and an SCX (Strong Cation Exchange) 5µm/85Å material. Each column supports a recommended maximum sample loading capacity of approximately 0.1µg with a capillary bed volume at 0.19µL or less. Unpacked and Conductive Column Assemblies are also available.

Capillary Sample Trap Column Assemblies include one or more 1µm NanoFilter™ Capsules, each containing either a stainless steel (SST) or bio-compatible titanium (Ti) frit. The swept volume of these unique filters is only 10nL each. Connect your 360µm OD capillary tubing directly to our Sample Trap Column Assemblies using the fittings provided. Each Capillary Sample Trap Column Assembly is rated to 5,000 psi (345 bar). The maximum flow rate for these products is 10µL/min; 250nL is the optimal flow rate.

The Conductive Sample Trap Columns allow voltage to be applied to the flow stream via stainless steel filter holders and NanoFilter Capsules. Apply voltage easily using our Insulating Mounting Bracket. These products are perfect for integration into CE or mass spectrometry systems.

Please Note: reversing flow in these columns can result in loss of packing material. For a sample trap setup.



Try our Column Coupler, which makes it possible to directly connect two or more columns in sequence (see below). Please contact us for more information on our Capillary Sample Trap Columns.



Sample Trap Column Assembly Components Chart:

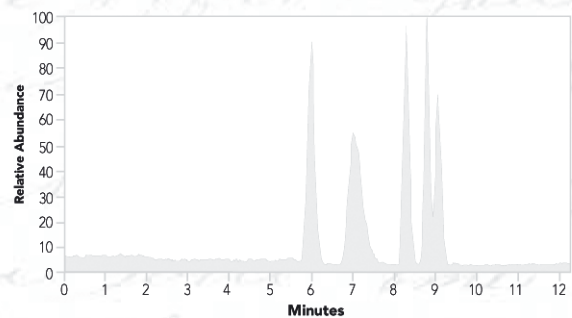
Please refer to the drawing and part numbers below when ordering replacement components:

Column Assembly (a)	Nuts (a)	Ferrules (b)	Filter Holder Color(c)	NanoFilter (d)	Column (e)	Capsule Union or NanoFilter (f)
Non-Conductive						
C-1200	P-416	F-152	Tan	M-125 (SST)	C-1250 (C18)	M-124NF (no frit)
C-1300	P-416BLK	F-152	Tan	M-126 (Ti)	C-1250 (C18)	M-124NF (no frit)
C-1400	P-416G	F-152	Black	M-126 (Ti)	C-1450 (SCX)	M-124NF (no frit)
C-1500	P-416	F-152	Tan	M-125 (SST)	FS-1000-25 (unpacked)	M-125 (SST)
C-1600	P-416BLK	F-152	Tan	M-126 (Ti)	FS-1000-25 (unpacked)	M-126 (Ti)
Conductive						
C-1700	P-416	F-152	SST	M-128 (SST)	FS-1000-25 (unpacked)	M-128 (SST)
C-1900	P-416	F-152	SST	M-128 (SST)	C-1250 (C18)	M-128NF (no frit)
C-2000	P-416G	F-152	SST	M-128 (SST)	C-1450 (SCX)	M-128NF (no frit)

All nuts, ferrules, and column holders are made of PEEK™ polymer. Filter holders are made of PEEK polymer (non-conductive) or stainless steel (conductive). NanoFilter Capsule bodies are made of PEEK polymer (non-conductive) or stainless steel and PEEK (conductive). See page 34 for NanoFilter Capsule color coding.

Abbreviation Key: SST = stainless steel; Ti = titanium; SCX = Strong Cation Exchange

Example Separation Chromatogram of Five Angiotensins:



Chromatographic Conditions, using C18 Sample Trap Column:

Binary Gradient	A: Water; B: Acetonitrile w/0.1% Formic Acid
Gradient Profile	2% B for 0.1 minutes Ramp to 95% B over 10 minutes Hold at 95% B for 4 minutes Return to 2% B over 1 minute
Flow Rate	250nL/minute
Injected Amount	≈500 femtomoles per peptide



Application Note

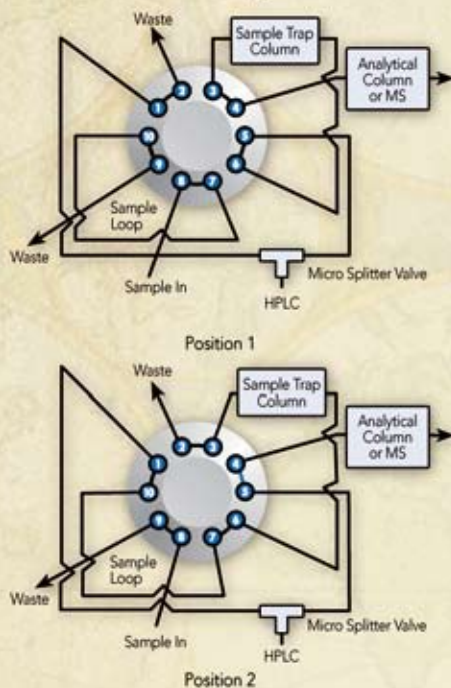
Uses for Capillary Sample Trap Columns

- » Rapid sample analysis
- » Nanobore guard column
- » Sample prep (placed into an injection loop)

Sample Purification and Concentration

An easy and effective way to purify and concentrate a sample before injection is to couple a Capillary Sample Trap Column with a Rheodyne® MX Nano-Scale Ten-Port Switching Valve (page 81) and an Upchurch Scientific® MicroSplitter Valve (page 104), if needed, to reduce the incoming flow rate.

In the configuration below, the sample is loaded into a sample loop (Position 1), and then flushed to the Sample Trap Column (Position 2) for concentration and purification. Switching the valve back to Position 1 will load the purified sample into the analytical column or send it to a mass spectrometer.



Note

>> Use the P-116 MicroFerrule Plug to plug a Sample Trap Column for storage.

>> Find 360µm OD PEEK™ polymer and fused silica tubing.

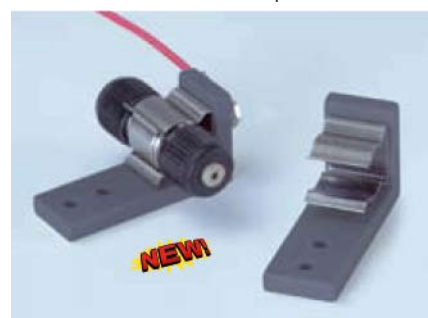
INSULATING MOUNTING BRACKET

Use our new Insulating Mounting Bracket to easily integrate the following Upchurch Scientific® products into your system or lab:

- Conductive Micro Union
- Conductive Mini MicroFilter
- Conductive Capillary Sample Trap Column

Just snap the product into place on the bracket. Voltage from your lead wire is conducted through the attaching stainless steel nut and screw (included), then onto the mounted product via the stainless steel clip.

The bracket's base includes two holes (#2 screw clearance) for easy mounting onto any lab surface. Dimensions are 1.25" L x .45" W x .63" H. Insulating Mounting Bracket, shown with lead wire and Conductive MicroTight Union, not included.



CAPILLARY SAMPLE TRAP COLUMNS

Assemblies, Non-Conductive*

- C-1200** **C18 Column, SST Frit**
Includes (1) 2-pk C-1250 Columns and (1) M-125 NanoFilter™
- C-1300** **C18 Column, Ti Frit**
Includes (1) 2-pk C-1250 Columns and (1) M-126 NanoFilter
- C-1400** **Strong Cation Exchange (SCX) Column, Ti Frit**
Includes (1) 2-pk C-1450 Columns and (1) M-126 NanoFilter
- C-1500** **Unpacked Column, SST Frits**
Includes (1) FS-1000-25 Column and (1) 2-pk M-125 NanoFilters
- C-1600** **Unpacked Column, Ti Frits**
Includes (1) FS-1000-25 Column and (1) 2-pk M-126 NanoFilters

Assemblies, Conductive*

- C-1700** **Conductive Unpacked Column, SST Frits**
Includes (1) FS-1000-25 Column and (1) 2-pk M-128 NanoFilters
- C-1900** **Conductive C18 Column, SST Frits**
Includes (1) 2-pk C-1250 Columns and (1) M-128 NanoFilter
- C-2000** **Conductive SCX Column, SST Frits**
Includes (1) 2-pk C-1450 Columns and (1) M-128 NanoFilter

Column Coupler and Replacement Parts*

		Swept Volume	Qty.
C-1210	Column Coupler, PEEK	—	ea.
C-1250	C18 Columns, 100µm ID x 2.5cm x 360µm OD	—	2-pk
C-1450	Strong Cation Exchange (SCX) Columns 100µm ID x 2.5cm x 360µm OD	—	2-pk
F-152	MicroFerrule for 360µm OD tubing, PEEK	—	ea.
FS-1000-25	Unpacked Column, 100µm ID x 2.5cm x 360µm OD	—	ea.
M-124NF	Capsule Union, no Frit, PEEK	9.5nL	ea.
M-125	1µm NanoFilter Capsules, with SST Frits	10nL	2-pk
M-126	1µm NanoFilter Capsules, with Ti Frits	10nL	2-pk
M-128	1µm Conductive NanoFilter Capsules, SST Frits	10nL	2-pk.
M-128NF	Conductive Capsule Union, no Frit, SST	13nL	ea.
P-416	Female Nut, Natural PEEK	—	ea.
P-416BLK	Female Nut, Black PEEK	—	ea.
P-416G	Female Nut, Green PEEK	—	ea.

INSULATING MOUNTING BRACKET

- M-447** **Insulating Mounting Bracket**

* Please refer to the Components Chart on page 36 for a full list of replacement parts for each assembly. SST = Stainless Steel; Ti = Titanium

NANOTIGHT™ FITTINGS AND SLEEVES

For Coned Ports

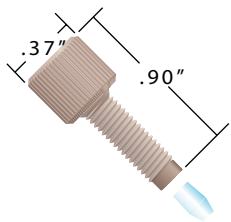
* For Connecting Capillary Tubing to Standard 10-32 Coned Ports

* 10-32 Fittings and 1/16" OD Sleeves for Capillary Tubing Sizes from 70µm - 1mm OD

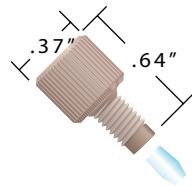
Upchurch Scientific® NanoTight Fittings and Sleeves are designed to connect 70µm – 1mm OD capillary tubing to any standard 10-32 coned port normally intended for 1/16" OD tubing. Select the sleeves appropriate for the OD of your capillary tubing. For instance, choose F-239x for 190µm OD tubing, F-242x for 360µm OD tubing, and F-247x for 1/32" OD tubing. Each sleeve is color-coded for easy identification.

The 1.6" long Teflon® FEP NanoTight Sleeves withstand up to 50°C, and can be finger tightened to hold to 4,000 psi (276 bar) when using our NanoTight Fittings. For added convenience, try the NanoTight Kits, which include four F-330N NanoTight Fittings and ten NanoTight Tubing Sleeves.

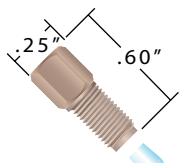
Select from our expanded line of PEEK™ NanoTight Fittings, featuring several head style and length options. Each 10-pack of nuts includes ten Tefzel® F-142N Ferrules.



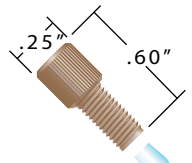
F-330N
Long Standard Head Nut
with F-142N Ferrule



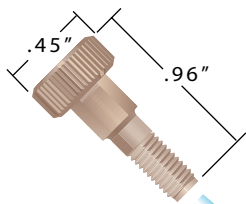
F-331N
Short Standard Head Nut
with F-142N Ferrule



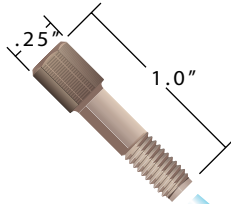
F-332N
Short Hex Head Nut
with F-142N Ferrule



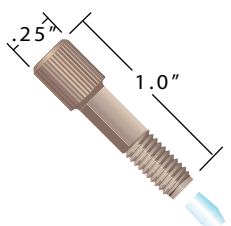
F-333N
Short Headless Nut
with F-142N Ferrule



F-334N
Long Knurl/Hex Head Nut
with F-142N Ferrule



F-335N
Long Hex Head Nut
with F-142N Ferrule



F-336N
Long Headless Nut
with F-142N Ferrule



Please Note: Connect capillary tubing into 1/4-28 or M6 ports using NanoTight Sleeves with our VacuTight™ or Super Flangeless™ flat-bottom fittings.

NANOTIGHT FITTINGS

All NanoTight Nut 10-packs include a 10-pack of Ferrules (F-142Nx)

ID	Description	Qty.
F-142Nx	Ferrules, Natural Tefzel (ETFE)	10-pk
F-330Nx	Long Nuts, Std. Head, Natural PEEK, 10-32	10-pk
F-331Nx	Short Nuts, Std. Head, Natural PEEK, 10-32	10-pk
F-332Nx	Short Nuts, Hex Head, Natural PEEK, 10-32	10-pk
F-333Nx	Short Nuts, Headless, Natural PEEK, 10-32	10-pk
F-334Nx	Long Nuts, Knurl/Hex Fat Head, Natural PEEK, 10-32	10-pk
F-335Nx	Long Nuts, Hex Head, Natural PEEK, 10-32	10-pk
F-336Nx	Long Nuts, Headless, Natural PEEK, 10-32	10-pk

NANOTIGHT FEP TUBING SLEEVES, 1/16" OD

ID	For Tubing OD Size	Color	Qty.
F-237x	125µm (.005")	Red	10-pk
F-238x	180µm (.007")	Yellow	10-pk
F-239x	215µm (.0085")	Natural	10-pk
F-240x	280µm (.011")	Blue	10-pk
F-241x	330µm (.013")	Orange	10-pk
F-242x	395µm (.0155")	Green	10-pk
F-243x	455µm (.018")	Black	10-pk
F-244x	535µm (.021")	Natural	10-pk
F-245x	610µm (.024")	Red	10-pk
F-246x	685µm (.027")	Yellow	10-pk
F-247x	840µm (.033")	Green	10-pk
F-252x	1.07mm (.042")	Purple	10-pk

NANOTIGHT KITS

Each kit contains a 10-pack of the indicated FEP Tubing Sleeves and (4) F-330N NanoTight Fittings.

1237	F-237x Tubing Sleeves and Fittings Kit
1238	F-238x Tubing Sleeves and Fittings Kit
1239	F-239x Tubing Sleeves and Fittings Kit
1240	F-240x Tubing Sleeves and Fittings Kit
1241	F-241x Tubing Sleeves and Fittings Kit
1242	F-242x Tubing Sleeves and Fittings Kit
1243	F-243x Tubing Sleeves and Fittings Kit
1244	F-244x Tubing Sleeves and Fittings Kit
1245	F-245x Tubing Sleeves and Fittings Kit
1246	F-246x Tubing Sleeves and Fittings Kit
1247	F-247x Tubing Sleeves and Fittings Kit
1252	F-252x Tubing Sleeves and Fittings Kit
1250	NanoTight Connector Kit

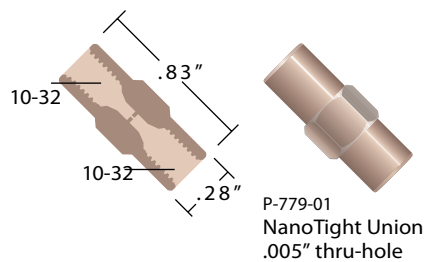
Kit contains: (6) each of FEP Tubing Sleeves F-239 – F-247; (5) each of F-330N and F-331N NanoTight Fittings; (5) each of F-335N and F-336N NanoTight Fittings; and (2) P-779-01 NanoTight Unions.

NANOTIGHT™ UNIONS

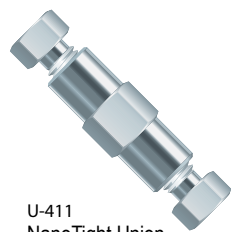
Upchurch Scientific® NanoTight Unions improve capillary tubing connections in several ways. The sleeving system and internal design of the unions greatly reduce the incidence of tubing misalignment. The webbed thru-hole minimizes breaking of fused silica at the junction point while adding only miniscule swept volume (8nL for the P-779-01 and 13nL for the U-411). The results are fewer blockages, fewer flow rate reductions and fewer back pressure problems.

Connect capillary tubing with these unions using the NanoTight Fittings and Sleeves listed. These versatile unions can also be used to connect capillary tubing to 1/16" OD tubing, or to connect two 1/16" OD tubing lines. To connect 1/16" OD tubing with our P-779-01, use any standard polymer 10-32 coned fittings, such as our NanoTight Fittings. To connect 1/16" OD tubing with our U-411, use the included fittings.

The pressure holding capability of the NanoTight Unions depends on the fittings and tubing sleeves selected. Please refer to the pressure ratings of these products.



P-779-01
NanoTight Union
.005" thru-hole



U-411
NanoTight Union
.007" thru-hole
with fittings included

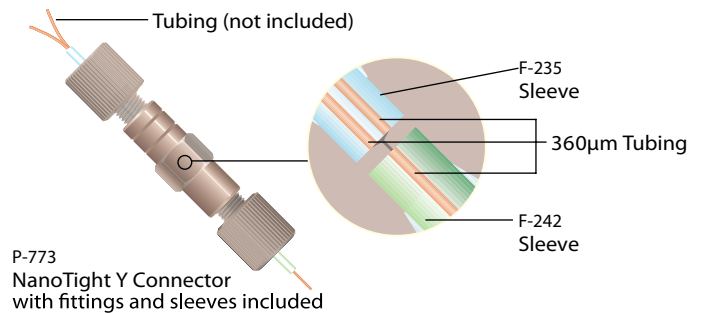
NANOTIGHT Y CONNECTOR

*** Only 17nL of Swept Volume!**

This product improves laminar flow over traditional MicroTee designs. The result is less turbulence and mixing when combining two fluid paths into one, or splitting one fluid path into two. This assembly holds to 4,000 psi (276 bar), has a .006" thru-hole, and a swept volume of only 17nL.

The Upchurch Scientific NanoTight Y Connector uses an included 1.6" long Dual-Lumen Silica NanoTight Tubing Sleeve to accommodate two 360µm OD capillary tubing lines. The single inlet/outlet end of the Y Connector uses the included F-242 NanoTight Tubing Sleeve, also designed for 360µm OD capillary tubing.

The NanoTight Y Connector comes complete with NanoTight Fittings. The body of this product is made of PEEK™ polymer, while both of the included tubing sleeves are made of Teflon® FEP. Replacement NanoTight Tubing Sleeves and fittings are available. Use F-242 replacement sleeves or choose from the other available sleeves to connect capillary tubing with ODs ranging from 70µm to 1mm. Dual-Lumen F-235 Sleeves are listed below, and are only available for 360µm OD tubing.



P-773
NanoTight Y Connector
with fittings and sleeves included

NANOTIGHT UNIONS

		Threads	Thru-hole	Swept Volume
P-779-01	Union, PEEK, Natural	10-32 to 10-32	.005" (130µm)	8nL
U-411	Union, Stainless Steel Includes (2) U-400 and (2) U-401 Fittings.	10-32 to 10-32	.004" (180µm)	13nL

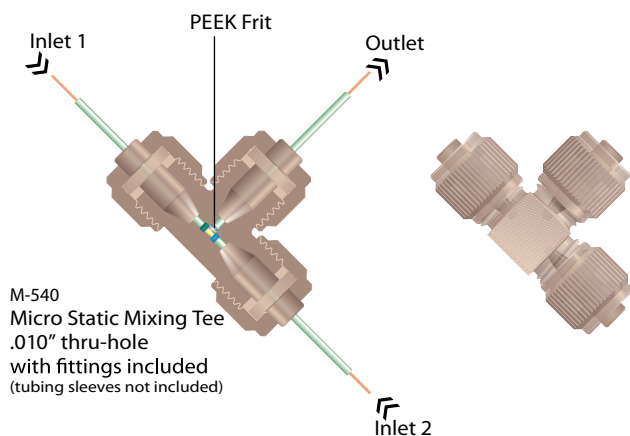
NANOTIGHT Y CONNECTOR

		Thru-hole	Swept Volume
P-773	NanoTight Y Connector , for 360µm OD tubing Includes (1) F-235, (1) F-242 Tubing Sleeve and (2) F-331N Fittings	.006" (150µm)	17nL
F-235x	Dual-Lumen NanoTight Tubing Sleeves , Natural FEP, for 360µm OD tubing, 10-pk		

MICRO STATIC MIXING TEE

The Upchurch Scientific® Micro Static Mixing Tee has a low swept volume of only .95µL* and is designed for flow rates of 20-250µL/min. The center port features a 0.5µm PEEK™ polymer frit to aid in mixing. This frit adds a maximum of 20 psi (1.4 bar) back pressure to most systems (within the stated flow rate range). Constructed of PEEK and Kel-F® (PCTFE), this mixing tee is chemically resistant and biocompatible. It handles a maximum pressure of 5,000 psi (345 bar). Connect capillary tubing using our NanoTight™ Sleeves. No sleeves are required for 1/16" OD tubing.

Please Note: turbulent mixing of solvents often increases outgassing. Therefore, we recommend solvent degassing when using this product (See the Rheodyne® Vacuum Degassing Systems).



M-540
Micro Static Mixing Tee
.010" thru-hole
with fittings included
(tubing sleeves not included)

CONDUCTIVE PERFLUOROELASTOMER FERRULE

* For Mass Spec Electro spray Applications

Try the Upchurch Scientific Conductive Perfluoroelastomer Ferrule in your electro spray applications. Unlike most graphite ferrules, the elastomeric properties of this ferrule let you use it through many tightening/retightening cycles. It also eliminates any possibility of graphite contamination in your system. The robust qualities of perfluoroelastomer allow the ferrule to be used at temperatures from -15°C to 260°C.

Connect 360µm OD fused silica or PEEK polymer tubing into any standard 10-32 coned port designed for 1/16" OD tubing with this ferrule. Like graphite ferrules, you can apply voltage through a metallic port block or metallic nut, allowing voltage to translate to the flow path through the ferrule.

Use the Conductive Perfluoroelastomer Ferrule with any of the Fingertight Nuts listed or NanoTight™ Nuts. To order one of these nuts without its standard ferrule, replace the "x" at the end of the nut's product number with "-01". Please Note: the "-01" denotes a single nut without the accompanying ferrule.



M-215
Conductive
Perfluoroelastomer Ferrule
for 360µm OD tubing

Note

>> Our NanoMixer™ is designed for flow rates ranging from sub microliter to 500µL/min.

>> Our Static Mixing Tee is designed for flow rates from 500µL/min. to 3mL/min.

Note

For alternative ways to introduce voltage to a flowstream in micro- and nanoscale applications, please see our Conductive MicroTight® Union, Application Note , Conductive Mini MicroFilters, and Conductive Capillary Sample Trap Columns.

MICRO STATIC MIXING TEE

	Thru-hole	Swept Volume
M-540 Micro Static Mixing Tee** for 1/16" OD tubing	.010" (.25mm)	.95µL*
Includes (3) F-132 and (3) P-416 Fittings		

CONDUCTIVE PERFLUOROELASTOMER FERRULE

	Qty.
M-215 Conductive Perfluoroelastomer Ferrule, Black For 360µm OD Tubing	ea.

* Includes frit volume

** The frit in this product cannot be changed.

1/16" OD PEEK™ TUBING SLEEVES

**For Connecting Capillary Tubing to Standard 10-32 Ports
Require the Use of Wrench Tightened Stainless Steel Nuts**

Like the NanoTight™ FEP Sleeves, these PEEK Tubing Sleeves are designed to be used with 1/16" OD, 10-32 threaded fittings to adapt capillary tubing to standard coned ports. Made of PEEK polymer, these 1.3" long sleeves can be used up to 125°C and will hold to 6,000 psi (414 bar). Please Note: These sleeves require a wrench tightened stainless steel nut to achieve proper sealing. We recommend our F-140 Two-Piece Fingertight Fitting, which includes a PEEK ferrule. Many researchers also use a stainless steel nut and ferrule with these sleeves, such as our U-400 and U-401. For a less expensive alternative that doesn't require wrench tightening, consider our NanoTight Tubing Sleeves and Kits.

1/32" OD TEFLON® FEP TUBING SLEEVES

These 1.6" long sleeves facilitate connecting capillary tubing into ports designed for 1/32" OD tubing. Please refer to the product listing below to select the appropriate sleeve for your capillary OD size. For instance, choose F-376 for 360µm OD and F-373 for 190µm OD capillary tubing. These sleeves are pressure rated to 1,750 psi (121 bar) and can be used at up to 50°C.

1/32" OD PEEK TUBING SLEEVES

Upchurch Scientific® 1/32" OD PEEK Tubing Sleeves are specifically designed to connect capillary tubing to our Nano Flow Sensor (pages 26 – 27) and 6-32 NanoPeak™ Valves (not in catalog). The 1.6" long sleeves can also be used with any fitting designed for 1/32" OD tubing when smaller tubing must be connected (see the Application Note on this page). Select the appropriate sleeve from the product listing for your capillary tubing OD size. The 1/32" OD PEEK Tubing Sleeves have a pressure rating of 5,000 psi (345 bar) and a maximum recommended temperature of 125° C.

Application Note

Use 1/32" OD PEEK or Teflon PFA Sleeves to connect capillary tubing with the following:

- >> The F-113 Ferrule and Two-Piece Fingertight Fittings for 10-32 ports
- >> The F-112 and P-416BLK MicroTight® Fittings for our Nano Flow Sensor — 1/32" OD PEEK Tubing Sleeves only.
- >> The 1/32" OD MicroTight Fittings
- >> The Rheodyne® RheFlex® M4 Fitting for MX Module applications.
- >> The M-645 Valco®-Compatible Fitting (page 42) for Valco Nanovolume® valve applications.



Tel: 800.426.0191 / 360.679.2528 · www.upchurch.com Clockwise, starting at top: 1/16" OD PEEK Tubing Sleeves, shown with F-140 Fitting; 1/32 OD PEEK Tubing Sleeves, shown with F-126H Fitting; 1/32" OD Teflon FEP Tubing Sleeves, shown with F-126S Fitting. Fittings and tubing not included.

1/16" OD PEEK TUBING SLEEVES

ID	For Tubing OD Size	Color	Qty.	
F-225	125µm (.005")	70 - 110µm	Red	ea.
F-226	180µm (.007")	125 - 165µm	Yellow	ea.
F-227	230µm (.009")	175 - 215µm	Yellow	ea.
F-228	250µm (.011")	225 - 265µm	Blue	ea.
F-229	330µm (.013")	275 - 315µm	Natural	ea.
F-230	405µm (.016")	350 - 390µm	Orange	ea.
F-231	560µm (.022")	505 - 545µm	Natural	ea.
F-234	685µm (.027")	630 - 670µm	Yellow	ea.
F-232	785µm (.031")	730 - 770µm	Natural	ea.
F-233	865µm (.034")	785 - 825µm	Blue	ea.

1/32" OD PEEK TUBING SLEEVES

ID	For Tubing OD Size	Color	Qty.	
F-380x	125µm (.005")	70 - 110µm	Red	10-pk
F-381x	180µm (.007")	125 - 165µm	Yellow	10-pk
F-382x	205µm (.008")	150 - 190µm	Natural	10-pk
F-383x	230µm (.009")	175 - 215µm	Gray	10-pk
F-384x	255µm (.010")	200 - 240µm	Blue	10-pk
F-387x	250µm (.011")	225 - 265µm	Red	10-pk
F-388x	330µm (.013")	275 - 315µm	Black	10-pk
F-385x	380µm (.015")	325 - 365µm	Natural	10-pk
F-386x	510µm (.020")	455 - 495µm	Orange	10-pk

1/32" OD TEFLON FEP TUBING SLEEVES

ID	For Tubing OD Size	Color	Qty.	
F-370x	75µm (.003")	20 - 60µm	Natural	10-pk
F-371x	125µm (.005")	70 - 110µm	Red	10-pk
F-372x	180µm (.007")	125 - 165µm	Yellow	10-pk
F-373x	230µm (.009")	175 - 215µm	Natural	10-pk
F-374x	280µm (.011")	225 - 265µm	Blue	10-pk
F-375x	330µm (.013")	275 - 315µm	Orange	10-pk
F-376x	395µm (.0155")	340 - 380µm	Green	10-pk

RHEFLEX® M4 FITTINGS

For Coned Ports

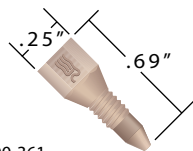
* For 1/32" OD Tubing

The Rheodyne® RheFlex M4 Fitting is designed to connect 1/32" OD tubing in MX Module applications (see pages 80 – 83). This PEEK™ fitting has a one piece design, which eliminates the need for a separate nut and ferrule. The M4 Fitting design provides dependable zero dead volume connections for micro and nano applications. Due to the unique RheFlex gripping design, the M4 Fitting will hold to 5,000 psi (345 bar) on PEEK or fused silica tubing. A PEEK M4 Plug is also available.

Use Rheodyne ChromTRAC™ knobs with the RheFlex M4 Fitting for fingertight convenience and to color-code connections.



6000-360
M4 Fitting
M4 threads
for 1/32" OD tubing



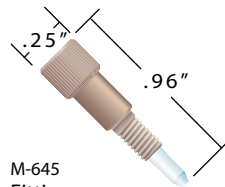
6000-361
M4 Plug
M4 threads

VICI® (VALCO)-COMPATIBLE FITTINGS*, 6-40 THREADS

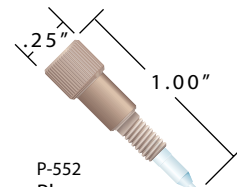
For Coned Ports

* For 1/32" OD and Capillary Tubing

The Upchurch Scientific® M-645 Fitting for 1/32" OD tubing is a robust, one-piece alternative for the Valco Nanovolume™ 6-40 threaded fitting. Our product consists of a PEEK polymer nut and an integrated Kel-F® (PCTFE) ferrule. Capillary tubing can also be connected with this fitting using the 1/32" OD Teflon® Tubing Sleeves listed. Please refer to the table below for pressure rating data. Also available is the P-552 Plug, for unused 6-40 threaded Valco ports.



M-645
Fitting
6-40 threads
for 1/32" OD tubing



P-552
Plug
6-40 threads

Note

Find 1/32" OD tubing on the following pages:

DuPont Teflon® Brand Resin FEP Sleeves for Capillary Tubing 41
PEEK 67
PEEKsil™ 68
Teflon FEP 71
Stainless Steel 75

Pressure Ratings^{1,2}:

	1/32" OD Tubing Sleeve	Tubing	Pressure Rating
Fitting for Valco-Compatible 6-40 Port	—	FEP, 1/32" OD x .005" ID	3,000 psi (207 bar)
	—	PEEK, 1/32" OD x .005" ID	2,750 psi (190 bar)
	—	Stainless Steel, 1/32" OD x .005" ID	3,250 psi (224 bar)
M-645	F-376, 395µm ID	FEP, 360µm OD x 75µm ID	1,750 psi (121 bar)
	F-376, 395µm ID	PEEK, 360µm OD x 75µm ID	1,750 psi (121 bar)
	F-376, 395µm ID	Fused Silica, 360µm OD x 75µm ID	1,750 psi (121 bar)

¹ This chart is intended for reference only and refers to the pressure rating of the fittings, NOT the tubing. Tests were conducted with room temperature water as the solvent. Your results may vary depending on the specific port and tubing materials, tubing ID, actual tubing diameters (with manufacturers' tolerances), temperature, chemical compatibility, etc.

² The fittings were finger tightened for these tests.

* Upchurch Scientific manufactures many products designed as direct replacements for OEM components. Reference to these manufacturers does not imply their endorsement of our products.

RHEFLEX M4 FITTINGS FOR CONED PORTS

	Qty.
6000-360 M4 RheFlex Fittings, for 1/32" OD Tubing, Natural PEEK	10-pk
6000-361 M4 RheFlex Plugs, Natural PEEK	10-pk

VICI (VALCO)-COMPATIBLE FITTINGS FOR 6-40 CONED PORTS

	Qty.
M-645x Fittings for 1/32" OD Tubing, Natural PEEK/Kel-F	10-pk
P-552 Plug for 1/32" OD Tubing Port, Natural PEEK/Kel-F	ea.



LEE COMPANY “MINSTAC®”- COMPATIBLE FITTINGS*, 6-40 THREADS

For MINSTAC Valve Ports

*** Easy to Use**

*** For 1/16" OD and Capillary Tubing**

Upchurch Scientific® TinyTight™ Fittings are easy-to-use alternatives for Lee Company 062 MINSTAC fittings systems. These Upchurch Scientific fittings consist of a 6-40 threaded PEEK™ polymer nut and a TinyTight Ferrule. To use, simply slide a fitting head-first onto your tubing, followed by the ring and ferrule, and thread this assembly into the solenoid valve receiving port, while making sure the tubing is bottomed out. No collets, colletting tools or chamfering tools required!

Choose from two ferrule options, with .020" and .030" thru-holes. Both are designed to connect 1/16" OD tubing. You may also connect capillary tubing having outside diameters from 70µm to 1mm with these ferrules, using our NanoTight™ Sleeves.

For maximum pressure ratings, please refer to the table below.

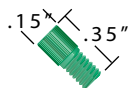
Please Note: our previous fittings designed for MINSTAC 062 ports (M-640 and M-642) have been replaced by these fittings.



M-647
TinyTight Ferrule
for 1/16" OD tubing
.020" thru-hole



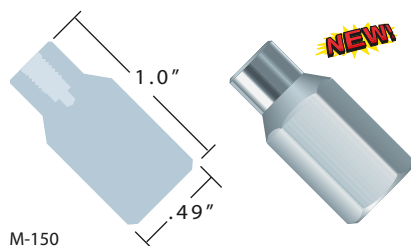
M-657
TinyTight Ferrule
for 1/16" OD tubing
.030" thru-hole



M-644-03
Headless Nut
6-40 threads

TINYTIGHT SWAGING TOOL

Make quick and easy 6-40 TinyTight tubing assemblies with this new tool. The tool is specifically designed for use with the Upchurch Scientific M-647 and M-657 Ferrules, 6-40 threaded M-644-03 Nut and 1/16" OD tubing (see fittings above). To use, first place the tool in a vise, then tighten tubing, fitting and ferrule into the tool as you would into any port. Once removed, the swaged ferrule will be held in place on the tubing.



M-150

Upchurch Scientific manufactures many products designed as direct replacements for OEM components. Reference to these manufacturers does not imply their endorsement of our products.

SUPER FLANGELESS FITTINGS, 6-40 AND 6-32 THREADS

For Flat-Bottom Ports

*** For 1/16" OD and Capillary Tubing**

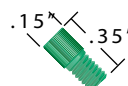
This Upchurch Scientific fittings system connects 1/16" OD and capillary tubing into any flat-bottom 6-40 or 6-32 threaded port. The 316 stainless steel ring of the Super Flangeless system offers constant, uniform compression on the ferrule while operating as a bearing against the nut. Thus, the nut can spin freely against the ferrule system, preventing the tubing from twisting during the tightening process. Once swaged, the lock ring holds the ferrule in place on the tubing, a benefit that also makes this fittings style ideal for tubing assemblies since the ferrule keeps the nut from sliding off the tubing.

Connect 1/16" OD tubing into 6-40 flat-bottom ports using the M-650 Ferrule and M-644-03 Nut. For 6-32 flat-bottom ports, use the M-650 Ferrule with the M-660 Nut. Use our Teflon® FEP NanoTight Sleeves with these fittings to connect capillary tubing with OD sizes between 70µm and 1mm. Both headless nuts are made of PEEK polymer. For easy tightening, try our N-290 Extender Tool.

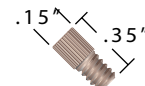
For maximum pressure ratings, please refer to the table on this page.



M-650
Super Flangeless Ferrule
for 1/16" OD tubing



M-644-03
Headless Nut
6-40 threads



M-660
Headless Nut
6-32 threads

Pressure Ratings^{1,2}:

1/16" OD Tubing Sleeve	Tubing	Pressure Rating
Fittings for MINSTAC-Compatible 6-40 Port M-647 / M-657, M-644-03	FEP, 1/16" OD x .010" ID	600 psi (41 bar)
	PEEK, 1/16" OD x .010" ID	1,500 psi (103 bar)
	Stainless Steel, 1/16" OD x .010" ID	4,000 psi (276 bar)
Fittings for 6-40 Port M-650, M-644-03	FEP, 1/16" OD x .010" ID	1,750 psi (121 bar)
	PEEK, 1/16" OD x .010" ID	3,750 psi (259 bar)
	Stainless Steel, 1/16" OD x .010" ID	3,750 psi (259 bar)
	F-376, 395µm ID Fused Silica, 360µm OD x 75µm ID	750 psi (52 bar)
Fittings for 6-32 Port M-650, M-660	FEP, 1/16" OD x .010" ID	1,750 psi (121 bar)
	PEEK, 1/16" OD x .010" ID	3,750 psi (259 bar)
	Stainless Steel, 1/16" OD x .010" ID	3,750 psi (259 bar)
F-376, 395µm ID	Fused Silica, 360µm OD x 75µm ID	750 psi (52 bar)

¹ This chart is intended for reference only and refers to the pressure rating of the fittings, NOT the tubing. Tests were conducted with room temperature water as the solvent. Your results may vary depending on the specific port and tubing materials, tubing ID, actual tubing diameters (within manufacturers' tolerances), temperature, chemical compatibility, etc.

² The fittings were finger tightened for these tests.

LEE COMPANY-COMPATIBLE FITTINGS FOR 6-40 PORTS

	Qty.
M-644-03x Headless Nuts for 1/16" OD tubing, Green PEEK	10-pk
M-647x TinyTight Ferrules for 1/16" OD tubing, .020" thru-hole, Natural PEEK/SST	10-pk
M-657x TinyTight Ferrules for 1/16" OD tubing, .030" thru-hole, Black PEEK/SST	10-pk

SUPER FLANGELESS FITTINGS FOR 6-40 AND 6-32 FB PORTS

	Qty.
M-644-03x Headless Nuts for 1/16" OD tubing, 6-40, Green PEEK	10-pk
M-650x Ferrules for 1/16" OD tubing, Natural PEEK/SST	10-pk
M-660 Headless Nuts for 1/16" OD tubing, 6-32, Natural PEEK	ea.

TINYTIGHT SWAGING TOOL

M-150 6-40 TinyTight Swaging Tool, SST	
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FB = Flat-bottom; SST = Stainless Steel