



## Upgrading the UltiMate 3000 RSLCnano System with ProFlow Technology



# **Quick Installation Guide**

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### 1. General Information

The ProFlow<sup>™</sup> flow meter is designed for Thermo Scientific<sup>™</sup> Dionex<sup>™</sup> UltiMate<sup>™</sup> 3000 RSLCnano systems equipped with NCS-3500RS or NCP-3200RS modules. Follow the steps given below to change from a Classic flow meter to the ProFlow flow meter.

#### **General Installation Steps**

- Upgrade Chromeleon™ Chromatography Data System/ SII software
- Upgrade firmware as necessary
- Turn off the NCx pump
- Exchange the Classic flow meter with the ProFlow flow meter
- Exchange the capillaries and connections
- Install the solvent shut off valves and elbow connector solvent lines
- Turn on the NCx pump
- Re-configure (delete/add) the NCx-3x00RS module in the Chromeleon / SII Instrument configuration
- Purge and calibrate the system
- Run the Detailed Leak Test for the NCx pump to check flow connections are tight

#### Parts required to upgrade NCS-3500RS or NCP-3200RS modules

Description	Part No.
ProFlow flow meter, with thermal flow sensors for nano LC	6041.7850
Upgrade kit for ProFlow flow meter	6041.3003
Including accessories required to upgrade an NCS-3500RS or NCP- 3200RS module with the ProFlow flow meter:	
Solvent lines, elbow tubes, shut-off valves Capillaries for the NC pump (nanoViper, MP35N) Chromeleon 7.2 SR4 or later software DVD SII for Xcalibur™ software DVD Fitting plugs, Viper	
Note: Firmware 1.40 or later is required to operate the ProFlow flow met NCx-3x00RS modules.	er with

- Thermo Standard Instrument Integration (SII) for Xcalibur 1.2 and DCMSLink for Xcalibur can coexist on one PC.
- Chromeleon 6.80 SR15b or later is needed to control RSLCnano systems with ProFlow technology (this is not included in the upgrade kit).



### 2. Software Installation to Support ProFlow Technology

**Note:** Install the software in accordance with the installation guidelines for the relevant software package and the operation instructions for the respective NCx-3x00RS module.

#### 2.1 LC Setup

The following full Chromeleon license software versions are available

- Chromeleon 6.80 SR15b or later
- Chromeleon 7.2 SR4 or later

#### 2.2 LCMS Setup

For LC-MS installations with the ProFlow flow meter and Thermo Scientific Mass Spectrometry (MS) instruments, the following software options are available:

SII 1.2 for Xcalibur or later (an upgrade with Chromeleon 7.2 SR4 or later is required)

**Note:** SII can only be used for Thermo Scientific MS detectors which operate under Thermo Scientific Foundation 3.x or later.

**Note:** DCMSLink for Xcalibur **does not** support the ProFlow flow meter and cannot be used to control an UltiMate 3000 RSLCnano system fitted with ProFlow technology which is coupled to a Thermo Scientific MS detector.

- Chromeleon 7.2 SR4 or later for UltiMate 3000 RSLCnano systems coupled with:
  - Thermo Scientific Exactive series instruments
  - o ISQ<sup>™</sup> single quadrupole instruments
  - o TSQ 8000<sup>™</sup> triple-quadrupole GC/MS instruments
  - TSQ Endura<sup>™</sup> quadrupole MS instruments
  - o TSQ Quantiva™ quadrupole MS instruments

**Note:** The Thermo Scientific MS detector is directly controlled by Chromeleon in contrast to SII for Xcalibur.

**Note:** Please check the list of supported hardware options in the software release notes or Chromeleon Help. A Chromeleon license is required to control the LC-MS system. Check the compatibility of Thermo Foundation and Xcalibur versions and Chromeleon 7.x for LC-MS control.

- DCMSLink 2.15 for HyStar<sup>™</sup> or later
- DII for Empower<sup>™</sup> 2.14 or later



### 3. Firmware Verification and Upgrade

**Note:** Software screenshots and examples below show the system configuration in Chromeleon 7 or SII.

- 1. Start the Instrument Configuration Manager under Thermo Chromeleon 7 in the Windows<sup>®</sup> **Start** menu.
- 2. Click **Add Instrument** and create an **Instrument Name**. If an existing instrument configuration is to be modified to accommodate the ProFlow flow meter, go to the next step.

New Instrument	×
Instrument <u>N</u> ame: DEGER-7523%21_2	]
ОК	Cancel

*Fig. 1: New instrument name window in Chromeleon Instrument Configuration Manager* 

3. Add (or delete and add for existing Instrument configuration) the relevant NCx-3x00RS module to the instrument configuration.

Manufacturers:	Modules:
Thermo Scientific IC: Dionex ICS-3000 Systems IC: Dionex ICS-5000 Systems IC: Dionex Integrated Systems IC: Dionex Modules HPLC: Vanquish HPLC: Dionex Summit Systems HPLC: Dionex Autoputification Systems HPLC: Synkotek Systems HPLC: Modules ESA Modules ESA Modules Extraction Modules Extraction Modules Mass Spectrometry	LPG-3400SD Pump     LPG-3400KRS Pump     LPG-3x00 Pump     LPG-3x00 Pump     MWD-3000(RS) Detector     NCP-3200RS Nano/Cap Pump     NCS-3500RS Nano/Cap System     DAS-3x00TXRS     PDA-3000 Detector     TCC-3x00(RS) Column Compartment
Generic ABI Agilent Berthold	WPS-3000(RS) Autosampler

Fig. 2: The Add module to instrument dialog in the Chromeleon Instrument Configuration Manager



4. Verify that the correct firmware version is installed in the **Messages Instrument Controller** (Audit Trail) of the Instrument Configuration Manager. If the firmware version is 1.40 or later, proceed to step 6.

🌯 Instrument Configuration - Chromeleon Instrument C	onfiguration Manager 🔂 🔂
<u>File Edit View Controller H</u> elp	
🖻 🖪   X 🖻 🖻 🔋 🛯 🛃 😜 🖋 💓 🗸	
DEGER-75Z3XZ1     DEGER-75Z3XZ1     Degeneration	Messages Instrument Controller DEGER-75Z3XZ1 [Expert]
SSLCnano     SSLCnano     SWPS-3000(RS) Autosampler [Simulation]     SMVD-3A00(RS) Detector [Simulation]     SMVD-3A00(RS) Nano/Cap System [Simula	Instrument Controller DEGER-7523X21 connected Int34 06 PM use obsyden (from DEGER-7523X21) has connected Chromeleon Instrument Configuration Manager to this controller In44 00 PM PumpNC35200 - UtilMate NCS-5500R5 Driver, Version 1.21.0.8134, RC version - Thermo Fisher Scientific confidential - Not for salel Copyright 2009-2015 Thermo Fisher Scientific Inc. All rights reserved. In44 00 PM (PumpNdoule) Trying to connect In44 00 PM (PumpNdoule) Connection established successfully. In44 00 PM (PumpNdoule) Connection established successfully. Int40 DM (PumpNdoule)

Fig. 3: Instrument configuration manager with the added NCS-3500RS module

5. Open the **NCx Configuration** window and go to the **General** tab. Select firmware version 1.40 or later from the dropdown menu and click on **Install** to upload the firmware. Wait until the module reboots and the Audit Trail reports successful completion of the firmware download before proceeding.

NCS-3500RS Configuration	×
Oven / Valves   Columns   Signals   Relays   Inputs   Flowmeter   General   Pumps   Limits (Loading)   Solvents (Loading)   Limits (NC)   Solvents (NC)	
Device Type NCS-3500RS	
Connection Connection Mode Module Address: USB-8097830 Browse	
Firmware NCS3000 hex, Version: 1.40	
OK Cancel Help	

Fig. 4: The General tab for the Pump Device showing the firmware update

6. Save the modified configuration to the Instrument controller (server).



### 4. Installation of the ProFlow Flow Meter

**A Important:** To avoid damage from electrostatic discharge, wear appropriate earthing protection during the replacement procedure.

- 1. Turn off the NCx-3x00RS pump module by switching off the power switch on the rear of the module.
- 2. Disconnect the capillaries connected to the flow meter inlets and outlet.



Fig. 5: NC pump with Classic flow meter (detailed view)

No.	Description
1	Leak sensor
2	Rear seal wash system detector
3	Peristaltic pump
4	Purge screw
5	Flow meter inlet
6	Pump lights (hidden by the front panel door in this figure)
7	Connector for the pressure transducer cable (working pressure of the pump head)
8	Flow meter outlet
9	Purge outlet
10	Pump head

3. Unplug the pressure transducer cables.



- 4. Loosen the two screws that attach the flow meter and pull the flow meter out toward the front.
- Install the ProFlow flow meter.
   Note: Be careful not to pinch any tubing.
- 6. Fasten the attaching screws on the flow meter and plug in the pressure transducer cables.
- 7. Exchange the capillaries and U tubes on the NC pump, with the capillaries from the upgrade kit. This includes:
  - Capillaries from the working cylinder to the equilibration cylinder (U-tube) on both pump heads of the NC pump.



Fig. 6: U-tube for the NC pump of NCx-3x00RS module

- The capillary from the right pump head to the flow meter inlet.
- The capillary from the left pump head to the flow meter inlet



Fig. 7: Capillary from the pump head to the flow meter inlet

**1 Tip:** The new capillaries can also be used with a Classic flow meter.



8. Install the solvent shut off valves and elbow pieces on solvent lines A and B.



*Fig. 8: Solvent shut-off valve and example schematic of an elbow piece* 

- **Tip:** With the ProFlow flow meter, the shut off valves are required during the Zero Balance Adjustment. The shut off valves allow the solvent flow through the system to be shut off at the solvent reservoir, for example, to prevent solvent from flowing through the system when a pump flow of zero is required for a long period, such as during calibration.
- 9. Turn on the module by pressing the power switch on the rear of the module.



Fig. 9: Detail view of NCS-3500RS pump module with installed ProFlow flow meter



### 5. Instrument Configuration with the ProFlow Flow Meter

#### 5.1 System Configuration

- 1. Start the Instrument configuration manager under Thermo Chromeleon 7 in the Windows **Start** menu.
- 2. Remove the NCx-3x00RS pump module from the configuration and then add it again. This will ensure that all new features are available for the ProFlow flow meter.
- 3. Verify the following settings:
  - The flow meter type (flow meter tab) is set to **ProFlow**.
  - The solvent lists show the predefined solvents (Water, ACN\_100%, ACN\_80%, MeOH).
  - The signals page shows the signal channels for the ProFlow flow meter as Enabled (NC\_Pump\_Flow, NC\_Pump\_Flow\_LeftBlk, NC\_Pump\_Flow\_RightBlk).

NCS-3500RS Configuration
General Pumps Limits (Loading) Solvents (Loading) Limits (NC) Solvents (NC)
Uven / vaives   Columns   Signais   Helays   Inputs   Howneed
Flowmeter Type ProFlow Update
Left Solvent List Water,ACN_100%,ACN_80%,Methanol
Right Solvent List Water, ACN_100%, ACN_80%, Methanol
OK Cancel Help

Fig. 10: NCS-3500RS module configuration window with the Flowmeter tab active in the Chromeleon Instrument Configuration Manager



4. Customize the configuration of your module with the ProFlow flow meter as required.

NCS-3500RS Configuration
General Pumps Limits (Loading) Solvents (Loading) Limits (NC) Solvents (NC) Oven / Valves Columns Signals Relays Inputs Rowmeter
Oven Device Name ColumnOven
Temperature Channel         I Use Channel         Channel Name         ColumnOven_Temp         Valves         Left Valve       Valco 10 Port, 2 Position         Right Valve       Valco 10 Port, 2 Position
OK Cancel Help

Fig. 11: NCS-3500RS module configuration window with active Oven/Valves tab in the Chromeleon Instrument Configuration Manager

- 5. Add the other relevant modules of your RSLCnano system to reflect the installed hardware.
- 6. Save the modified configuration to the Instrument controller (server).



#### 5.2 Client Access in SII (no LC-MS control)

If Chromeleon is used for LC-MS control, proceed to section 5.3, page 12.

1. Start the instrument configuration under the Thermo Foundation 3.x folder in the Windows **Start** menu and add SII for Xcalibur to **Configured Devices**.

Thermo Foundation Instrument Configuration Device Types : All	
Available Devices:         View         Dionex         Dionex         Dionex         Chromatography         Fibre         Thermo Scientific SII         For Xcalibur         G Exactive - Orbitrap         MS	Configured Devices: Thermo Scientific SII for Xcalibur Graduater Allower States Graduater Al
Add >>	< Remove Configure
Done	Help

Fig. 12: Thermo Foundation Instrument Configuration window

The image above shows the Thermo Foundation Instrument Configuration window: Left side displays installed drivers (available devices) for DCMSlink for Xcalibur, Thermo Scientific SII, Velos<sup>TM</sup> Pro mass spectrometer and Q Exactive<sup>TM</sup> – Orbitrap<sup>TM</sup> mass spectrometer; right side displays the devices configured for operation.

2. Click on the **Configure** button.



3. Select the configured RSLCnano system with ProFlow flow meter.

SII for Xcalibur Configuration	×
<u>C</u> onfigure Device	
<u>S</u> elected instrument system: RSLCnano ▼	
Controlled by <u>e</u> xternal autosampler	
OK Cancel <u>H</u> elp	

Fig. 13: SII for Xcalibur Configuration window with selected RSLCnano system

- 4. Open Xcalibur in the Thermo Xcalibur folder in the Windows **Start** menu.
- 5. Click on the **Direct Control** button to open the ePanels for direct control of the RSLCnano system.

AutoSampler			
Connected	Inject Position:	RA1	
Status: Idle	Temperature:	20.0 [°C]	
DAD			
Connected	Wavelength UV1	: 190 [nm]	=
			-
	III	•	

- Fig. 14: Xcalibur window segment with the configured RSLCnano system and Direct Control button to access the Chromeleon ePanels
  - 6. Select the NCx-3x00RS Pump ePanel in the Chromeleon Console.

#### 5.3 Client Access in Chromeleon

- 1. Start Chromeleon 7 in Thermo Chromeleon 7 folder in Windows **Start** menu.
- 2. Click on Instruments in Category Bars (lower left corner in the Console).
- 3. Select the NCx-3x00RS Pump ePanel.



### 6. ProFlow Flow Meter Purging and Calibration



1. Purge both pump heads of the NC pump for about 15 minutes.

Fig. 15: NC\_pump segment of NCx-3x00RS ePanel with installed ProFlow flow meter

**Note:** Follow the instructions in the **Ready Check Results** window and open both purge screws.

**Tip:** The partial flows for channel A and B are displayed along with the total flow on the **NC\_Pump** segment of the ePanel.

Flowmeter -		459.12 [bar]	0.300 [μl/min]	
Flow values A: 276.5 [nl/min]	B: 23.4	4 [nl/min] 1	[otal: 299.9 [nl/min]	

*Fig. 16: A part of the NC\_pump segment of an NCx-3x00RS ePanel* 



Source	Device	Message
	PumpModule.NC_Pump	Purging will deliver a high flow to your system. Ensure that the purge valve is open to protect your column(s) and fluidic system

Fig. 17: Ready Check Results window appears after the NC pump blocks purge is executed

After purging the pump heads, purge the ProFlow flow meter for about 10 minutes.
 Note: Follow the instructions in the Ready Check Results window and close both purge screws.

	Source	Device	Message
•		PumpModule.NC_Pump	Check that the purge valves of the NC pump blocks are closed. Check that the column is not connected with the flow meter outlet.

*Fig. 18: Ready Check Results window appears after the flow meter purge function is executed* 



3. Start the Adjust Zero Balance test on the NC Pump Wellness tab. A wizard will guide you through the procedure.

NC_Pump - Wellness		
Wellness: NC_Pump Instrument: RSLCnano		
NC_Pump Adjust Zero Balance Detailed Leak Test Left Block NC_Pump Calibrate Work. Press. Transducer Dock Pistons Undock Pistons Piston Postion Status: Unknown	Calibrate Solver Pight Block NC_Pump Calibrate Work. Press. T Dock Pistons Undock Piston Piston Position Status: Unknown	nt
ance - Instrument: nanoLC-ProFlow - Computer: ABECKERLT1	Pump Detail	s
Zero B Zero Balance - Instrument: nanoLC-ProFlow - Computer: ABECKERLT1 Zero Balance: NC_Pump est Deta un this pr	Test Steps 1 Prepare Pump 2 Adjust Zero	Pump Details Serial No.: 0001 Firmware Version: 1.40.00 Last Service Date: 2016-01-18 Pump Type: NCS-3500RS
ne to ass		
<ul> <li>alance of alance of Open both purge valves of the flow meter and connect tubes to the purge outlets which direct the liquid into syringes or a waste bottle.</li> <li>Make sure that the solvent shut-off valves are open.</li> <li>Done</li> <li>2 Did you purge the pump and the flow meter for at least 15 minutes each after the last solvent change?</li> </ul>	<ul> <li>4. Close the purge purge</li> <li>Done</li> <li>5. Connect the meta the accessories solvent that migh tissue or a beake</li> <li>Done</li> </ul>	valves. al Viper capillary 6041.7892 from to the pump outlet and collect t leak out of the open end with a ar.
<ul> <li>alance of alance of the alance of the lagrance of the liquid into syringes or a waste bottle.</li> <li>Make sure that the solvent shut-off valves are open.</li> <li>Done</li> <li>Done</li> <li>C Did you purge the pump and the flow meter for at least 15 minutes each after the last solvent change?</li> <li>Yes No</li> <li>Viet Start</li> <li>Click the button to start purging the pump blocks.</li> </ul>	<ul> <li>4. Close the purge of Done</li> <li>5. Connect the meta the accessories is solvent that might tissue or a beake</li> <li>Done</li> <li>6. Wait until the purn least 60 minutes has reached at least eached each</li></ul>	valves. al Viper capillary 6041.7892 from to the pump outlet and collect t leak out of the open end with a ar. hp has been turned on for at or the flow meter temperature aast 33 °C. The current 3.5 °C. The pump is on for

Fig. 19: Wellness window in NC\_pump segment and Zero Balance wizard



4. Set the solvent types for the left and right block to match your application in the **More Options** tab of the NC\_pump group of NCx-3x00RS ePanel.

NC_Pump	NC Pump - More Options	
More Options		
Wellness Service	More Options: NC_Pun	np
Motor: On       Purge: Off       Flowmeter	Purge Purge Purge What: Time: 30.0 [min]	Pump Blocks Pressure         Left Block:       668.36 [bar]         Right Block:       660.69 [bar]
	Status	Flow Ramps
	Perform Self Test	Max. Up: Infinite 🚔
	Selftest Passed: Yes	Max. Down: Infinite
	Solvents	
	Left Block:	
	Right Block: _ACN_80%	<b></b>

*Fig. 20: More Options window of the NC\_Pump segment in the NCx-3x00RS module ePanel* 

- **1** Tip: The ProFlow flow meter comes pre-calibrated for the four standard solvents: Water, 100% Acetonitrile, 80% Acetonitrile with 20% Water, and 100% methanol (MeOH). The calibration values for these solvents are valid for the entire life time of the ProFlow flow meter. A recalibration of the solvent types is **not** necessary if the ProFlow flow meter is removed from the system and installed in another NCx-3x00RS pump module.
- **1** Tip: Separate solvent calibrations are **not** required with the addition of up to 2% of a solvent additive (e.g. for 2% acetonitrile / 98% water, the solvent type '\_Water' can be used. Similarly, small amounts of phase modifiers (<1%) e.g TFA, FA do not need to be taken into account for the solvent calibration.
- **1** Tip: A solvent calibration is **only** necessary for a solvent composition that differ significantly from pre-calibrated standard solvents and has not previously been calibrated for the ProFlow flow meter. Once a solvent type calibration has been made, the solvent calibration is valid for the lifetime of the ProFlow flow meter. Click Solvent calibration on the Wellness tab in NC\_pump section of NCx-3x00RS module to access a Wizard that will guide you through the procedure. The procedure will take around 1 hour and will require manipulation with fluidics.



- 5. Calibrate the working piston pressure transducers of the left and right blocks as follows:
  - Click on the **Wellness** tab In the NC\_pump group.
  - Select either the left of the right NC pump block one of the Calibrate Work.
     Press. Transducer buttons to start the procedure.
  - A Ready Check message is displayed.

F	Ready Chec	k Results		? ×					
	Ready check result: Successful, however there are one or more warnings.								
		Source	Device	Message					
			PumpModule.NC_Pump.NC_Pump_Wellness_LeftBlock	Before executing this command perform the following actions: Run the 'Adjust Zero Balance' procedure. Close the flow meter outlet with					
			Before executing this command p	erform the following actions: Run					
			the 'Adjust Zero Balance' procedu a Viper fitting plug. Verify that the	re. Close the flow meter outlet with					
11			a riper nang plag. Ferriy alar ale	parge rarree are cheeca.					
				Execute despite warnings Cancel					
1									

*Fig. 21: Ready check results window appeared after commencing the working pressure transducer calibration* 

- Close the flow meter outlet with the Viper plug.
- Close the purge valves.
- Press **Execute** despite warnings.

**Tip:** Successful completion of the WP calibration will be reported on the instrument display panel and in the Chromeleon Audit Trail.



*Fig.* 22: The message that shows the result of Working Pressure transducer calibration on the NCx-3x00RS module

	Date	Time	Retention	Device	Message	
	1/14/2016	9:11:12 PM +01:00	1.599		End While	
>	1/14/2016	9:11:12 PM +01:00	1.599		While SPmpL, Flowmode=Running: No	
	1/14/2016	9:11:12 PM +01:00	1.590	PumpModule.NC_Pu	Calibration of the working piston sensor of the left nano pump block finished.	
	1/14/2016	9:11:12 PM +01:00	1.590	PumpModule.NC_Pu	WP calibration succeeded. Please open the purge valve.	
-	1/14/2016	9:09:52 PM +01:00	0.261	1	While SPmpL Flowmode=Running: Yes	
	1/14/2016	9-09-47 PM +01-00	0.177	1	While SPeed Elevende-Bussies Yas	

Fig. 23: Audit trail zoom in that confirms successful calibration of working pressure transducers



- 6. Repeat the Calibrate Work. Press. Transducer routine for the second block (repeat the procedure described above).
- 7. Perform a Detailed Leak Test to check that all NC\_Pump flow connections are tight.
  - Click on the **Wellness** tab in the NC\_pump group.
  - Select the **Detailed Leak Test** and follow the instructions given in the wizard.

The system is now ready for operation!



### 7. Supporting Information

### Documents that are available for further reference.

- Operating Instructions for the UltiMate 3000 modules
- Installation Qualification manual for installation of the UltiMate 3000 RSLCnano system
- RSLCnano Standard Applications Manual
- Viper™ Capillaries and Finger Tight Fitting System Installation and Operation Guide
- Nano Connector for UltiMate 3000 RSLCnano Systems Installation Instructions
- Application/technical notes provided on the Thermo Scientific website

Item	Part No.	Quantity in the kit
Upgrade kit for ProFlow flow meter, including	6041.3003	
Capillary, nanoViper, MP35N (0.25 x 155 mm I.D. x L) To be used, for example, for calibrating solvents with the ProFlow flow meter or establishing the solvent viscosity with the Classic flow meter or for purging the flow meter.	6041.7892	1
NCS Pump head Capillaries		
Capillary from working cylinder to equilibration cylinder (U-tube)	6041.7888	2
Capillary from left pump block to flow meter inlet	6041.7890	1
Capillary from right pump block to flow meter inlet	6041.7893	1
Viper Fitting Plugs		
Fitting plug (Viper, titanium, biocompatible)	6040.2303	2
Solvent Shutoff Valves		
Solvent shut off valve	2265.0010	2
PTFE elbow tubing piece 1.0x3.0x100mm ID x AD x L	6040.8122	2
Software		
SII for Xcalibur Service Release DVD	4780.0384	1
Chromeleon 6.80 Service Release DVD*	4580.0316	1
Chromeleon 7 Service Release DVD	4580.0720	1

#### Table 1. Spare Parts

\*This item is not included as part of the upgrade kit.



1	I.D.[Color code] and corresponding part number								
(mm)	20 μm [Orange]	50 μm [Brown]	75 μm [Black]	100 μm [Red]	150 µm [Purple]				
70	6041.5120	6041.5123	6041.5126	6041.5810	6041.5817				
150	6041.5121	6041.5124	6041.5127	6041.5811	6041.5818				
250	-	-	6041.5730	6041.5812	6041.5819				
350	6041.5240	6041.5540	6041.5735	6041.5813	6041.5820				
450	-	-	-	6041.5814	6041.5821				
550	6041.5260	6041.5560	6041.5760	6041.5815	6041.5822				
650	6041.5275	6041.5575	6041.5775	-	-				
750	6041.5280	6041.5580	6041.5780	6041.5816	6041.5823				
950	6041.5122	6041.5125	6041.5128	-	-				

### Table 2. nanoViper tubing matrix