Purification

Modular Preparative Chromatography Solutions from Manual to Fully Automated Systems
PLC 2020 Purification System

LC Out of the Box!
A fully-functional liquid chromatography purification system, the PLC 2020 Personal Purification System features:
- Compact Footprint
- Simplified HPLC Software

The PLC 2020 Personal Purification System is ideally suited for tailored throughput, high pressure purification needs and is intended to assist an individual or a small group of chemists.

Wide Range of Purification Modes
Micro-gram to multi-gram sample load capabilities
- High Pressure
  - Reverse Phase
  - Normal Phase
  - Chiral
- Low Pressure
  - FLASH
  - Solid Load

Save Time and Improve Efficiency
- High Pressure Purification provides superior resolution

Running the System is Simple …
1. Tap Run on the main menu
2. Select Method and then tap Run
3. Load and inject the sample

Easy-to-Operate Software
- Intuitive purification focused interface
- Real-time, graphical gradient modifications
- Real-time sample tracking during run
- Conditional logic fraction collection based on two detector channels using any combination of Slope and/or Level
- Auto-Print and Auto-Export of reports at the end of a run
- Monitor the progress of the system without being next to it as run lights illuminate the racks during a run, turn off when the run is complete and flash if an error has occurred

PLC 2020 Overview

<table>
<thead>
<tr>
<th>Column Type</th>
<th>NP Flash Cartridge</th>
<th>C18 Flash Cartridge</th>
<th>HPLC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Column Size</td>
<td>150 – 340 g</td>
<td>40 – 120 g</td>
<td>10 mm ID</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>20 mm ID</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>30 mm ID</td>
</tr>
<tr>
<td>Flow Rate</td>
<td>65 – 100 mL/min</td>
<td>40 – 80 mL/min</td>
<td>2 – 10 mL/min</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>2 – 25 mL/min</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>2 – 50 mL/min</td>
</tr>
<tr>
<td>Loading Capacity</td>
<td>0.3 – 20 g</td>
<td>0.05 – 6 g</td>
<td>Up to 0.5 g</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Up to 2 g</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Up to 6 g</td>
</tr>
<tr>
<td>Injection Volume</td>
<td>&gt; 10 mL and solid injection</td>
<td>2 – 10 mL</td>
<td>0.020 – 0.100 mL</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>0.1 – 10 mL</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>0.5 – &gt;10 mL</td>
</tr>
<tr>
<td>Pressure</td>
<td>&lt; 100 psi</td>
<td></td>
<td>1500 – 3500 psi</td>
</tr>
</tbody>
</table>

Calculations based on Methanol/Water solvents - 5 µm column 150 to 250 mm length

A robust Purification system to last through the years
Analytical to Preparative HPLC System

Gilson High Performance Liquid Chromatography (HPLC) systems provide complete solutions for all purification needs. Front-end liquid handlers and autosamplers are available in a range of bed capacities and with footprints optimized for various bench space requirements.

GX Series Platforms
The GX series platforms feature a selection of bed capacity adapted to the user’s throughput needs:
- Allow injection and fraction collection on the same instrument
- The revolutionary GX Solvent System accommodates sample volumes ranging from microliters to hundreds of milliliters
- Numerous injection possibilities ranging from analytical to preparative

When size matters…

GX Series Bed Capacity

<table>
<thead>
<tr>
<th>Tube Diameter</th>
<th>GX-281 Sample Quantity (8 Racks)</th>
<th>GX-271 Sample Quantity (3 Racks)</th>
<th>GX-241 Sample Quantity (2 Racks)</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 mm</td>
<td>576</td>
<td>540</td>
<td>516</td>
</tr>
<tr>
<td>15 mm</td>
<td>576</td>
<td>480</td>
<td>500</td>
</tr>
<tr>
<td>16 mm</td>
<td>576</td>
<td>240</td>
<td>96</td>
</tr>
<tr>
<td>17 mm</td>
<td>576</td>
<td>220</td>
<td>88</td>
</tr>
<tr>
<td>18 mm</td>
<td>420</td>
<td>220</td>
<td>88</td>
</tr>
<tr>
<td>20 mm</td>
<td>240</td>
<td>70</td>
<td>-</td>
</tr>
<tr>
<td>28 mm</td>
<td>162</td>
<td>70</td>
<td>28</td>
</tr>
</tbody>
</table>

GX Prep Solvent System
- Syringeless technology with access to five off-bed solvents
- Injection volumes ranging from 100 µL to tens of mL
- Multiple dilution and rinsing solvents

GX Z Injection Module
- Innovative injection port design to reduce void volumes and minimize carryover
- Use two modules for analytical and preparative injection

Remove Solubility Issues
- “Sandwich” injection to avoid sample precipitation during the injection process:
  - Large injection volumes supported through solvent system and 1/8” injection loop.

Seamless Automation

Unique Solutions Built On Specific Needs
Labs and users have different needs and constraints. While others try to provide “one size fits all” solutions, Gilson uses modular components to tailor specific solutions that address current and future needs of our users. Some of the solutions that can be offered include:

Column Selection and Column Back Flush (Selection Set-up Shown)
Column selection for universal systems:
- Analytical method development and Scale Up to Preparative
- Multiple purification modes (RP, NP, Chiral, …)
- Purification followed by direct analysis of fractions in analytical
- Column backflush (not shown).

Fully Automated Sample Pre-Treatment and Injection
Liquid handling and injection capabilities on the same instrument allow multiple injections from the same sample, sample dilution, internal standard addition, sample cleanup by SPE, and more.

Automatic Fraction Re-Injection
The GX series instruments feature dual injection paths, enabling analytical and preparative injections on a single platform without compromising. TRILUTION LC software can automatically inject the collected fractions for purity confirmation or for secondary purification.

Gilson High Performance Liquid Chromatography (HPLC) systems provide complete solutions for all purification needs. Front-end liquid handlers and autosamplers are available in a range of bed capacities and with footprints optimized for various bench space requirements.

Performance, capacity and size to fit every laboratory need… from mg to gram scale purification
HPLC Pumps

Analytical, Semi-Preparative, and Preparative Pumping Solutions

Gilson offers unsurpassed flexibility in HPLC pumping systems with an extensive product range for a variety of pumping applications.

- Capable of fast separations with high-efficiency columns in normal and reverse-phase modes, Gilson pumps are the premier solvent delivery solutions for the analytical to preparative chromatography.
- Gilson dual-piston pumps for semi preparative and preparative chromatography feature high pressure mixing to guarantee gradient precision and reproducibility.

HPLC Detectors

From Analytical to Preparative Detection Solutions

UV/VIS Detection

15X Series UV/VIS Detectors

Rugged detectors operate in single wavelength, dual wavelength, or scan wavelength mode.

171/172 Diode Array Detectors

Accurate detectors with an optional remote flow cell design. Ideal for compound identification (spectral library) and peak purity calculations.

Flow Cell Selection Chart for Optimizing Sensitivity on 15X Series Detectors

Selecting the correct flow cell will optimize sensitivity and peak shape.

Other Detectors

Preparative Refractive Index Detector, Fluorometer, Radioactivity, …

The Gilson 506C System Interface allows the collection of analog signals (up to 4) to trigger fraction collection and for reporting.
LC/MS Purification System

It’s Your Chemistry… Simplified!

Your time is valuable. The quality of your data is crucial. That’s why Gilson has developed an LC/MS Purification System that is not only extremely easy to use and maintain, but has one of the largest mass ranges in the market today. Operation of the MS is completely integrated into the LC control software, facilitated by a few additional tasks and configuration entries when setting up a method.

Your Specifications
- Modular design means each component can be configured to your specifications.

Your Own Probe
- Quick-connect probe allows for users to have a dedicated probe. Just walk up and snap in to start, without worry of cross contamination in an open access environment.

Your Choice
- Choose to collect fractions on up to eight data signals using conditional logic based on any combination of UV, DAD, ELSD, and MS.

MS Detector

Quick-connect
Quick-connect feature allows each user to have a probe, preventing contamination between users in open access environments.

Rugged & Simple
Simple source maintenance allows for cleaning and maintenance without breaking vacuum—limiting instrument down time and increasing productivity in a rugged design.

Multiple Mode Operation
Ability to monitor in Full Scan, Extracted Ion and SIM (Selected Ion Monitoring) modes simultaneously.

Source Features
The source features XYZ adjustments of probe positioning to optimize spray in relation to the capillary entrance for higher flows and/or sample concentration and a transparent window for viewing the spray.

Selective Collection of Compounds with Weak UV Response
LC/MS Based Purification... The Ultimate in Efficiency
- Save time by collecting only compounds or impurities of interest
- Fraction spectra are displayed as they are collected for quick compound verification
- Graphical sample tracking of sample, chromatogram, and fraction spectra

Range & Speed
- Mass Range: 50 – 3,000 amu
- Scan Speeds up to 10,000 amu/sec

Selective Collection of Compounds with Weak UV Response

Split Ratio is Independent of Changes in the HPLC Flow

Active Splitter
Allows for large, selectable split ratio to enable the system to operate with a large flow rate range and column conditions

Meeting the growing demand for... simplified LC/MS based purification solutions
TRILUTION® LC Software

Gilson has redefined purification with our HPLC system control software, TRILUTION® LC. This liquid chromatography software, specifically designed for purification, offers control of the important run and collection parameters necessary to get the required results in terms of separation and recovery even when performing challenging applications.

Full Hardware Control Configuration
- All aspects of the equipment are set in the configuration tab in the method builder

Drag-and-drop tasks to specific time points for fast and easy method creation
- Gradient profile
- Hardware control tasks
- Fraction collection settings

Advanced Fraction Collection Capabilities
- Collect by time, volume, level, or slope
- Individual parameters for front and back slope
- Collection region settings: All, front, tail, APEX
- Collect co-eluting peak
- Collect non peak
- Divide peaks by time or volume
- Collect in different tubes for each injection or collect in the same set of tubes for repetitive injections

Conditional Fraction Collection
- Collect based on data from up to eight channels
- Conditional logic using AND, OR, AND/OR

Graphical Fraction Collection Optimization
- Change fraction collection parameters
- Overlay a chromatogram from a previous run
- Simulate the fraction collection

Automatic Processing
- Automatic sample list generation for post-collection fraction processing such as pooling or re-injection
- Automatic sample re-injection based on conditions such as peak area value or size

Visual Operation List
- Auto sample list generation
- Use of variables for easy scale-up from analytical to preparative runs

Real Time Viewing
- Real time chromatogram and fraction collection
- Real time Fraction Spectra for Mass Spec data

Real Time Action
Full access to all instruments during the run to:
- Change gradient profile to elute compounds or end injection
- Activate fraction collection, manually advance fraction tubes, and divert to waste
- Stop pumps

Graphical Sample Tracking
- Identify fraction from chromatogram

Open Access Module
- Administrator control & permission-setting capabilities
- Walk-up user access

Graphical Tasks
- Drag-and-drop tasks to specific time points for quick method creation

Apex: Collect the entire peak, but advances to the next tube at the Apex.
**Fraction Collectors**

**FC 203B/FC 204 Fraction Collectors**
Stand alone, compact fraction collectors. Collect by time, drop or peak in tubes, vials or microplates.

- 3-way diverter valve for collection by slope or level using detector signal
- Up to ten programmable time windows can be added for collecting only samples of interest, while discarding the column’s void volume, areas of non-interest and equilibration volumes
- Contact closure inputs are available to remotely start, advance or stop fraction collection
- Multi-column adapter for collecting up to 18 separate channels

**Specifications**

<table>
<thead>
<tr>
<th>Dimensions (w x d x h)</th>
<th>FC 203B: 32.4 x 29.2 x 26.7 cm (12.8 x 11.5 x 10.5 in)</th>
<th>FC 204: 47.9 x 46.4 x 33 cm (18.9 x 18.3 x 13 in)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Valve Switching Speed</td>
<td>100 msec</td>
<td></td>
</tr>
<tr>
<td>Liquid Contact Material</td>
<td>PTFE and 316 stainless steel</td>
<td></td>
</tr>
<tr>
<td>Max Flow Rate</td>
<td>FC 203B: 20 mL/min.</td>
<td></td>
</tr>
<tr>
<td>FC 204: 20 or 200 mL/min.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Gilon Publications and Education**

**Gilon HPLC Troubleshooting Guide**
Troubleshooting High Pressure Liquid Chromatography (HPLC) systems can be straightforward, despite the multiple components. With the helpful forms and checklists in our guide, troubleshooting Gilson HPLC is more simple than ever! Included in this guide are real-life examples using HPLC systems, with real problems and solutions, organized into a spiral bound guide. Eliminate problems that may be related to software, hardware, columns, solvents, or any combination of these. Simple tests to prove purification and reduce or eliminate carryover are also included!

**Gilon Application Notes Handbooks**
The complimentary Gilson Application Notes Handbooks showcase published applications and scientific advances using Gilson automation and pipettes in a number of different markets from chemists and laboratories around the world. We welcome you to submit your application to us for publishing in our handbooks.

Published applications offer everyone a chance to learn about the recent scientific highlights and new technologies.

**Gilon Seminars**
Attend our complimentary G.E.T. LIVE Web Seminars to learn about more scientific advances with industry leading applications and technologies from TODAY! Gilson is the host for our guest speakers, who lead the industry with their innovative methods and techniques.

For an archive of our G.E.T. LIVE Web Seminar Recordings, please visit: http://gilsonwebregistration.podbean.com/gilon-web-seminars-registration-page/
Contact training@gilson.com or visit www.gilson.com to learn more. It’s FREE!
Resources

Optimizing Preparative HPLC
There are numerous parameters and techniques to optimize preparative HPLC. Optimization will improve chromatography and percent recovery of collected fractions.

Separation Scale-up Equations
When scaling up from analytical scout runs to preparative purification, the main parameters to scale up are:

### Flow Rate

\[
\text{Flow rate preparative} = \text{mass analytical} \times \frac{\text{length preparative}}{\text{length analytical}} \times \left(\frac{\text{diameter preparative}}{\text{diameter analytical}}\right)^2
\]

### Mass

\[
\text{mass preparative} = \text{mass analytical} \times \frac{\text{length preparative}}{\text{length analytical}} \times \left(\frac{\text{diameter preparative}}{\text{diameter analytical}}\right)^2
\]

### Gradient Duration (GD)

\[
\text{GD preparative} = \text{GD analytical} \times \frac{\text{length preparative}}{\text{length analytical}} \times \left(\frac{\text{diameter preparative}}{\text{diameter analytical}}\right)^2 \times \frac{\text{flow rate analytical}}{\text{flow rate preparative}}
\]

### Pressure Equation

In preparative chromatography the back pressure generated by the column and the various tubing can become a constraint. At constant mobile phase viscosity, the pressure drop can be estimated:

\[
P_{c2} = \frac{P_{c1} x D_{c1}^2}{P_{c2} x D_{c2}^2}
\]

Where:

- \( P_{c1} \): Pressure on column 1 (psi)
- \( P_{c2} \): Pressure on column 2 (psi)
- \( D_{c1} \): Diameter of column 1 (in./mm)
- \( D_{c2} \): Diameter of column 2 (in./mm)

### Solid Injection on PLC 2020

Automatic Purity Checking on Gilson System

Advantage of dual injection paths and high pressure pumps for analytical and preparative works:

Inject several milliliters or do multiple injections on a preparative column. Then automatically switch to a very selective short analytical column and inject few microliters to quickly check purity of collected fractions. Pure fractions can be pooled to reduce evaporation time.

### Concentration Overloading on PLC 2020

Saturation of solid phase from on column front change peak shape. Late eluting peak is accelerated by earlier co-eluting compound.