Capillary and Packed Gas Chromatograph

GC-2014

The Shimadzu GC-2010 Plus represents a new generation in top end capillary GC analysis, redefining sensitivity limits for trace analysis, fast GC applications, and easy, robust operation. Advanced Flow Technology (AFT) capability further extends the applications scope of the instrument allowing multidimensional GC, capillary backflush, and other specialized flow applications. AFT additionally enables reduced analysis times, enhanced chromatographic resolution, and application-specific configurations without compromising key performance features.

The new detector line-up, featuring sensitivity specifications among the highest in the industry, ensures quality data across a broad range of applications.

High-end and High-speed Capillary Gas Chromatograph System

For research and method development

GC-2010 Plus
High Performance and Expandability Merged at a higher level

GC-2014
Capillary and Packed Gas Chromatograph
High Performance

Superior Performance
Improved design and innovative technology for all of our injectors, detectors and flow controllers equal or surpass our GC-2010 the high-end technology leader.

Easy Operation

Excellent User Interface
Large LCD, all digital gases control and auto-diagnostics inherited from the GC-2010 – “The Most advanced, easy-to-use interface”

Flexibility

Expandability for Every Situation
Use any column types for any analysis. Packed or capillary columns give you the freedom to choose the best technique for your measurement. Fully integrated multiple valve systems are made simple for optimum performance for SystemGC custom GC products.

Big Performance & Small Space
GC-2014
High Performance

Performance lifted to a higher level
The Highest available precision and accuracy similar to our industry leading GC-2010

Digital carrier gas control
Single or Dual AFC flexibility

Higher-level repeatability of carrier gas is indispensable to high data reliability. More accurate electronic flow controllers set and maintain flow rates in multiple modes automatically eliminating human error.

The GC-2014 Series is equipped with the advanced flow controller (AFC) technology inherited from the GC-17A Series and GC-2010 Series.

Higher-level repeatability of retention time and peak area, enabling a higher level of analyses.

This digital control is standard for not only capillary columns, but packed columns as well. Accurate flow rate control via AFC has higher-level repeatability of retention time and peak area, enabling a higher level of analyses.

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Our New FPD is used for all columns

Detectors

The detectors have been completely redesigned, incorporating the GC-2010 detector designs for capillary analyses and the GC-14 detector designs for packed columns. This TCD-2014 unit is ideal for packed column measurements employing the semi-diffusion cell design used in TCD-14. The newly designed FPD-2014 takes advantage of the holophotal construction of the FPD-2010. This is the simplest nozzle replacement no matter if you are using capillary or packed columns.

Unsurpassed accuracy

Injection Units

The design of the SPL-2014 capillary column sample injection unit is based on the GC-2010 technology. This accuracy was unattainable with previous models. The packed column sample injection unit employs the proven design of the GC-14 injection unit.

Analytical capacity is increased while maintaining small footprint

Column Oven

By using the GC-2010 control electronics and cooling mechanisms, column oven performance has been greatly improved over that of the GC-14 Series. Oven capacity is increased while keeping the same width as the GC-14, with enough capacity to accommodate both capillary and packed columns together.
Easy Operation

Easier to understand, simpler operation
Large display, help functions and pop-up screens loaded with productivity-enhancing functions

Large display
shows most analysis details at a glance, ideal for Chromatopac users.

A large LCD displays chromatograms and method parameters. This is a great improvement for Chromatopacs systems that do not have these real time displays.

Graphical user interface enables quick setting of all analytical conditions. The built-in Help function almost eliminates need for familiarization training.

Polarity display prevents injection errors

Easy-to-understand
Pop-up Screens

Graphical popup screen that clearly indicates the polarity so manual injection errors are prevented when using the dual packed column system.
Reduces unexpected downtime

**Intelligent Self-diagnostics**

Self-diagnostics validate that the instrument before injection. This function conducts a detailed diagnosis of the septum and glass insert operating lifetime, temperature sensor errors, supplied gas pressure, control status for each gas, ignition operation, DC voltage and AD converter. Regular diagnosis prevents unexpected downtime.

**Digital Control of Column Flow Rate and Split Ratio**

**AFC (Advanced Flow Controller)**

Using the electronic flow controller, the column inlet pressure, column flow rate, linear velocity and split ratio are easily digitally set. Flow meters have now become obsolete. It is no longer necessary to set flows with soap-film flow meters. No longer required to adjust complicated split ratio settings by measuring the split or column flows manually.

**Digital Control also for Packed Column Analysis**

**Dual AFC**

Easy setting of carrier gases flow by the electronic flow controllers (AFC) for both capillary and packed column analyses. For control of detector gas, select between Advanced Pressure Controller (APC) and low cost manual flow controllers. When manual flow controllers are used, a solenoid valve automatically turns ON/OFF the detector gas when the main unit power or detector is turned ON/OFF.
Flexibility

Expandability to Support all Types of Analysis
For varied and complicated analyses, an array of units and detectors provide quick, easy solutions

A Full Line of Injection Units
Obtaining better data requires that the appropriate column and sample introduction method be selected according to analytical objectives and samples to be analyzed. With the GC-2014, the optimum injection mode can be selected from four types of injection units.

Dual Packed Injection Unit
**DINJ-2014**
Designed for Dual FID and TCD analyses. Because two flow paths are handled using one temperature control port, these count as one heated zone.

Single Packed Injection Unit
**SINJ-2014**
This is a specialized sample injection unit for use with ECD or other high sensitivity detectors.

Split/Splitless Injection Unit
**SPL-2014**
Standard unit for high-speed analysis with a narrow bore column. The gas saver function restricts the total gas used. High-pressure injection standard

Direct Injection Unit
**WBI-2014**
Incorporates a septum purge flow path to restrict solvent tailing. Sharing glass inserts with splitless analysis simplifies parts requirements (patented).

Simultaneously Mount up to Three Injection Units and Four Detectors
Select from four types of injection units and five types of detectors according to the target compounds and analysis objective. Modular injection units, detectors and auto-injectors can be easily added after installing the unit in your lab.

### Flexibility

**Unit Addition**
- 4 types of injection units
- 5 types of detectors

**Options after Installation**
- Injection units / Detectors
- Auto-injectors
- Various options can be added
Compact, High-Sensitivity Detectors

The TCD employs the highly regarded semi-diffusion TCD cell of the GC-14 Series. High-selectivity detectors offer superb sensitivity realized by further improving the technology used in the GC-2010 detectors.

Flame Ionization Detector

**FID-2014**

Automatic ignition and re-ignition functions are standard. By mounting an APC or solenoid valve unit, a feedback function cuts off gas supply when the hydrogen flame is extinguished. Generally used for detection of organic compounds with a hydrogen carbon bond. An optional flame monitor is available. Single and dual FID’s are available.

Thermal Conductivity Detector

**TCD-2014**

The TCD-2014 is a semi-diffusion type cell reducing contamination and increasing cell lifetimes. Incorporates an automatic filament protection circuit. The TCD-2014 is used for analysis of inorganic gases and concentrated organic compounds.

Electron Capture Detector

**ECD-2014**

This cell is very similar to the ECD-14; so spare radiation sources can be shared. This detector is used for analysis of electrophillic compounds. Improved cell insulation and reduces contamination achieving higher sensitivity.

**CAUTION**

The ECD uses a radioactive Ni63 source. Special governmental registration is required to use or purchase it. Please check with your local Shimadzu representative for relevant regulations in your area.

Flame Photometric Detector

**FPD-2014**

The FPD-2010, the nozzle system was updated to provide support for packed column analysis while maintaining its high sensitivity. The ability to exchange nozzles optimizes both packed column and capillary column analyses. The FPD-2014 is compact with a high maximum temperature (350°C). This detector is used for analysis of organic sulphur compounds and organic phosphorus compounds such as residual pesticides and malodorous components.

*Filter replacement requires no tools.*
 Flame Thermionic Detector  
**FTD-2014C**

This specialized capillary-type detector employs the FTD-2010 mechanism. Used for analysis of organic nitrogen compounds and organic phosphorus compounds such as residual pesticides. The new collector construction allows replacement without tools. An optional alkali source regeneration kit recoats the bead reducing running costs.

*Collector replacement requires no tools.*

Flame Thermionic Detector  
**FTD-2014**

Packed column analysis is supported by the FTD-2014 using the FTD-14 mechanism and collectors from both the FTD-14 and -17.

Optional Units

A variety of options support various types of analyses

**AOC-20 Series**

The AOC-20i auto injector and AOC-20s auto sampler is used with the GC-2014. Varying the parameters of sample injection sets the optimal injection mode. This high level of precision and repeatability is not possible with manual injection.

**SystemGC**

A sub-door is included for SystemGC products. The column oven door is separated into the column and sub door. The sub-door can accommodate three temperature-controlled valves, and the left-side panel three valves that are not temperature-controlled. The PRG-2010 is used to control these valves. SystemGC’s are custom order products. For details, contact your Shimadzu representative.
Flexibility
Effective Use of GC Series Column Resources
Effective use of valuable column resources is maintained by using the 40-mm-pitch glass column the same as Shimadzu GC-7, 9, 12, 14, 15 and 16 Series.

Large Column Oven Facilitates Column Operations
Column replacement is easier by increasing the oven capacity while keeping its width the same.

Select Your Flow Controller Combination
Five slots for manual flow controllers are in the clear case atop the main unit.
Five AFC/APC slots are in the back bottom of the main unit. Gases are supplied or cut off in conjunction with switching ON/OFF power to the main unit or detector even if the low-cost manual controllers are used. All parameters for GC analysis are controlled digitally when APC’s are used to control detector gases. This facilitates the setting of analytical conditions and log management by a data station.
Application Systems
GC-2014 Analysis Systems for Every Application

Headspace Analysis System
• High reproducibility and low carryover ensure reliable quantitation for volatile component analysis.

System Configuration
• GC-2014 + HS-20 Long Transfer Line

Analysis Applications
• Measurement of residual solvents in pharmaceuticals
• Measurement of flavor components in foods

Simulated Distillation GC System for LabSolutions
• Measures the boiling point distribution of petroleum distillate using the relationship between retention time and boiling point.
• Analyzes distillation characteristics and prints specialized reports.

System Configuration
• GC-2014 + WBI-2014 + LabSolutions GC + Simulated Distillation GC Analysis Software (Select sample injection unit and column according to the target sample)

Analysis Applications
• Petroleum distillate

PONA Analysis System
• Separates gasoline or other hydrocarbon compounds, identifies the peaks and classifies them by carbon number, or by type (paraffin, olefin, naphthene and aromatic series) for quantitation.

System Configuration
• GC-2014 + CRG-2014 + GCsolution + PONAsolution + MS Excel (commercially available spreadsheet software) (Select sample injection unit and column according to the target sample)

Analysis Applications
• Categorization of naphtha, gasoline and gasoline-based materials by carbon number or type and their quantitation. (Also offers calculation of mean specific gravity, mean molecular weight, and octane value.)

Workstations
LabSolutions LC/GC Ver.5
• LabSolutions LC/GC Ver.5 is the next generation of chromatography data system that integrates control of GC* (GC-2010 Plus, GC-2010, GC-2014, GC-2025 and GC-14B) and LC and deliver greater network capability.
  * LabSolutions does not support Distillation GC Software and PONAsolution, please use GCsolution for these software.
  Note: CBM-102 is necessary for controlling GC-14B.

GCsolution Ver.2
• GCsolution Ver.2 supports not only GC-2014, but also GC-2025*, GC-2010 Plus*, GC-2010, GC-17A, GC-1700 and GC-14A/B.
  * GC-2010 Plus can be controlled by GCsolution Ver.2.32 or later and GC-2025 by GCsolution Ver.2.40 or later respectively.
  Note1: CBM-102 is necessary for controlling GC-17A, GC-1700 and GC-14A/B and the data acquisition.
  Note2: In controlling GC-14A, the workstation functionalities are partly limited like the detector range 4 cannot be used.
• Both LabSolutions and GCsolution software can control a maximum of four GC units in a computer. By inputting detector analog signal into CMB-102, data acquisition is possible even on other Shimadzu GC models that cannot be controlled by the software.

Chromatopac C-R8A*
• Acknowledged data processing functions and ease of operation
• Built-in validation functions
• High-speed RS-232C port provided standard
• Easy operation designed for factory use
  * Chromatopac C-R8A is not sold in EU area.
## Specifications

### Column Oven
- **Temperature range**: (Ambient + 10°C) - 400°C (using liquid CO2 gas) -50°C - 400°C
- **Dimensions**: 250(W) x 360(H) x 175(D) mm
- **Oven capacity**: 15 ML
- **Temperature accuracy**: ±1% (calibration at 0.01°C increments)
- **Temperature deviation**: 2°C max. (on 200mm dia. circumference 30mm from rear)
- **Temperature variation coefficient**: 0.01°C/C
- **Temperature program steps**: Up to 20 (cooling program possible)
- **Programmed rate setting range**: -250°C - 250°C/min
- **Total time for all steps**: 999.9 minutes max.
- **Linear heating range**: 30°C/min up to 150°C
- **Cooling rate**: 300°C - 50°C (in 6 min max. (at 25°C ambient temperature)
- **Columns accepted**: Capillary columns: 2
- **Packaged columns for GC-14B**: 4 (Glass columns: 2)

*Optional parts are required to use liquid CO2 gas.

### Sample Injection Unit
- **Temperature range**: Up to 400°C
- **Heating settings**: 1°C steps
- **No. of units installed simultaneously**: Up to 3 units
- **Sample injection unit types**: Dual packed, single packed, split/splitless, direct (AMC)

### Carrier Gas Flow Controller
- **For Packed / Dual**
  - **Flow rate setting range**: 0 - 100mL/min
  - **Programmable steps**: 7
  - **Programmed rate setting range**: -400 - 400mL/min
  - **Correction function**: Maintains column flow rate during column oven heating
- **For Capillary Split/Splitless, Direct**
  - **Split/splitless injection mode**
    - **Pressure setting range**: 0 - 970kPa
    - **Programmable steps**: 7 (pressure-decreasing program possible)
    - **Programmed rate setting range**: -400 - 4000kPa/min
    - **Split ratio setting range**: 0 - 9999.9
    - **Total flow rate setting range**: 0 - 12000mL/min
    - **Correction function**: Maintains column average linear velocity during column oven heating (for capillary only)
- **(Pressure mode direct injection)**
  - **Pressure setting range**: 0 - 970kPa
  - **Programmable steps**: 7
  - **Programmed rate setting range**: -400 - 4000kPa/min
  - **Correction function**: Maintains column average linear velocity during column oven heating (for capillary only)
- **(Flow-rate mode direct injection)**
  - **Flow rate setting range**: 0 - 1200mL/min
  - **Programmable steps**: 7
  - **Programmed rate setting range**: -400 - 400mL/min
- **For Single Packed, Direct (AMC)**
  - **Flow rate setting range**: 0 - 100mL/min
  - **Correction function**: Maintains column flow rate during column oven heating

### Detectors
- **Temperature range**: 400°C max. (FID, TCD, FTD) 350°C max. (ECD, FPD)
- **Temperature setting**: 1°C steps
- **No. of units installed simultaneously**: Up to 4 units (restricted depending on detector type)
- **Detector type**: FID, TCD, ECD, FPD, FTD for capillary/packed

#### Flame Ionization Detector (FID)
- **System**: Dual flow rate differential system
- **Temperature range**: 400°C max.
- **Minimum detected quantity**: 3pgC3 (dodecane)
- **Dynamic range**: 106
  - **Nozzle**: Quartz glass Standard: for packed, Option: for capillary

#### Thermal Conductivity Detector (TCD)
- **System**: Dual flow rate differential system
- **Temperature range**: 400°C max.
- **Dynamic range**: 106
- **Sensitivity**: 40,000mV/mL/mg (built-in pre-amplifier, with 10x amplification)

#### Electron Capture Detector (ECD)
- **System**: Fixed current system using 60mCi 370MBq radiation source
- **Temperature range**: 400°C max.
- **Minimum detected quantity**: 0.1pg (l-BHC)
- **Dynamic range**: 106
- **Sensitivity**: 40,000mV/mL/mg (built-in pre-amplifier, with 10x amplification)

#### Flame Photometric Detector (FPD)
- **System**: Dual flow rate differential system
- **Temperature range**: 350°C max.
- **Dynamic range**: 106
- **Minimum detected quantity**: P: 0.5pgf/s (tributyl phosphate)
- **S: 101
- **Minimum detected quantity**: P: 0.4pgf/s (azoxybenzene)
- **S: 0.05pgf/s (methylion)

### Display
- 240 x 320 dot graphics display (30 characters x 16 lines)

### Dimensions, Weight, Power Requirements (GC main unit)
- **Dimensions**: 400(W) x 690(H) x 607(D) mm
- **Weight**: 48kg (GC-2014AF model)
- **Power Requirements**: AC100V/120V 230V 1800VA (GC-2014AF model) or 2600VA (GC-2014AF model), 50/60Hz
High-end and High-speed Capillary Gas Chromatograph System

GC-2010 Plus

For research and method development

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