

Capillary and Packed Gas Chromatograph

# GC-2014



# High Performance and Expandability Merged at a higher level

## GC-2014

Capillary and Packed Gas Chromatograph



## High Performance

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### 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

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### 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

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### 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.

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.

Dodecane				Tetradecane				Hexadecane			
	RT	Area	Height		RT	Area	Height		RT	Area	Height
1	5.243	55397	34356	1	6.731	55379	33635	1	8.06	55898	33437
2	5.243	55418	34431	2	6.731	55529	34446	2	8.06	56170	33499
3	5.243	55762	34571	3	6.731	55880	34042	3	8.059	56486	33610
4	5.243	55632	34497	4	6.731	55717	34551	4	8.06	56347	32899
5	5.244	55861	34865	5	6.732	56021	34611	5	8.061	56572	33931
6	5.243	55957	35396	6	6.731	56060	34677	6	8.06	56780	33086
7	5.243	56026	35066	7	6.731	56120	34426	7	8.061	56714	34300
8	5.242	56083	35439	8	6.73	56164	34638	8	8.059	56694	33358
9	5.243	55770	34739	9	6.73	55937	33984	9	8.059	56509	34382
10	5.243	55857	34614	10	6.731	55762	34062	10	8.06	56510	33427
Average (Avg.)	5.243	55776.3	34797.4	Average (Avg.)	6.7309	55856.9	34307.2	Average (Avg.)	8.0599	56468	33592.9
Standard Deviation	0.000471	234.7737	387.9167	Standard Deviation	0.000568	258.8747	352.4608	Standard Deviation	0.000738	269.1274	482.072
C.V.%	0.008991	0.42092	1.114786	C.V.%	0.008433	0.463461	1.027367	C.V.%	0.009155	0.476602	1.435041

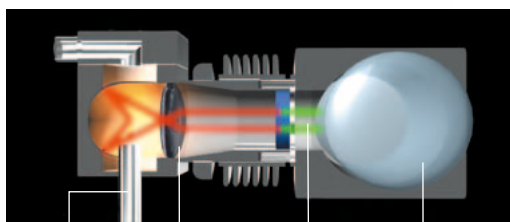


## Our New FPD is used for all columns Detectors

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.

Holophotal Flame Photometric Detector



Nozzle Lens Filter Photomultiplier

Quartz glass nozzle (for packed column analysis)



Stainless steel nozzle (for capillary column analysis)



Simple nozzle replacement supports both capillary and packed columns.

## Injection units with unsurpassed accuracy

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

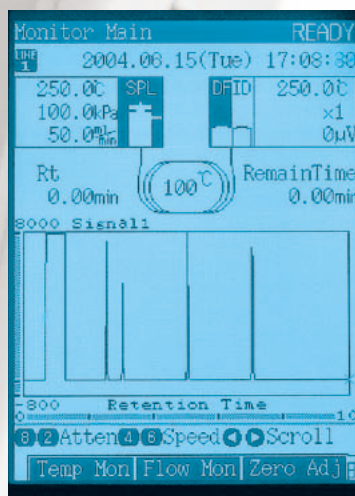
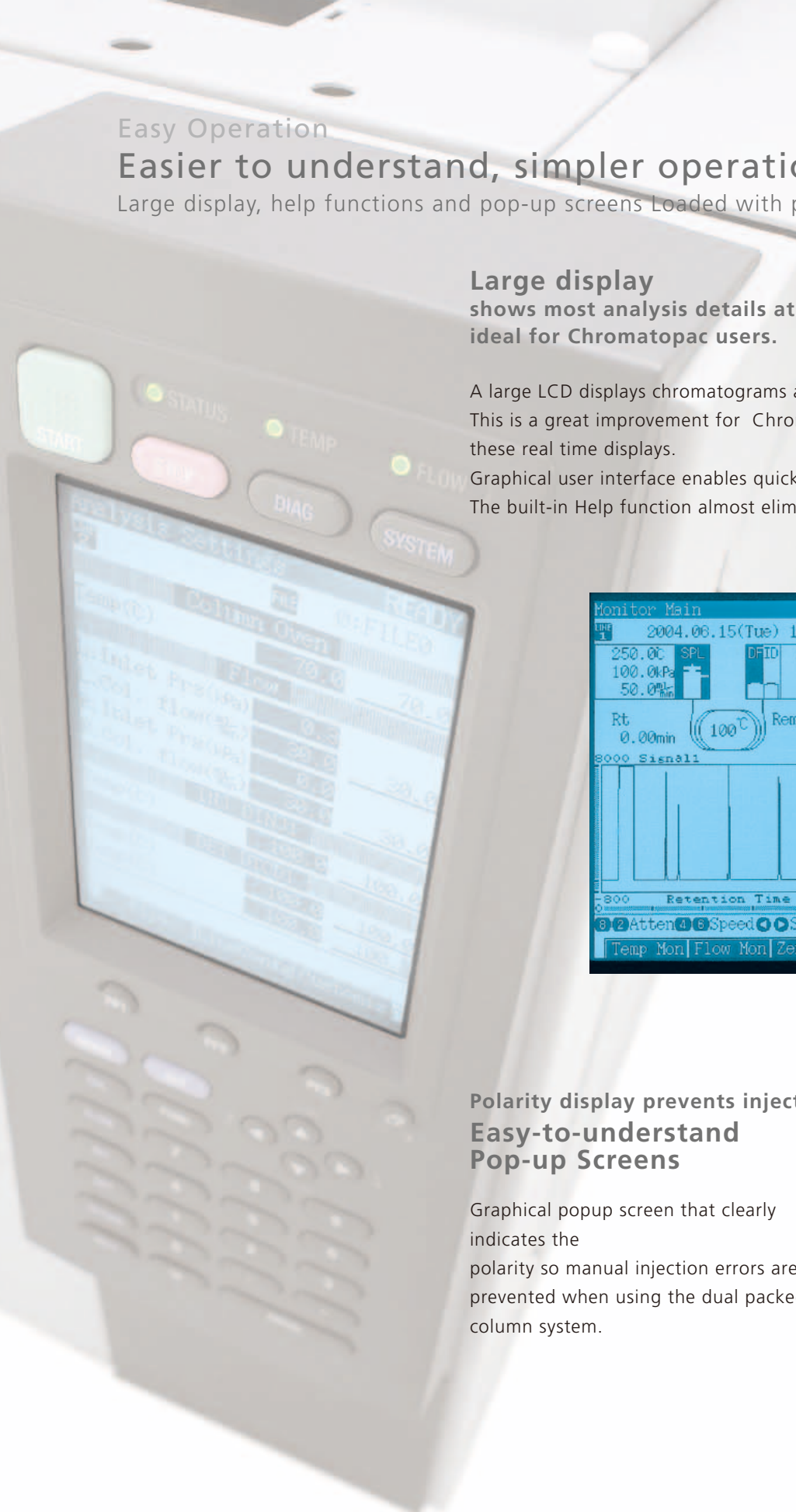
shows most analysis details at a glance,  
ideal for Chromatopac users.

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.



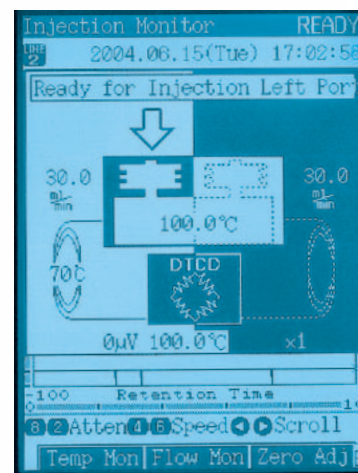
### Large Display

Chromatogram display  
Graphical UI  
Built-in Help Function

Polarity display prevents injection errors

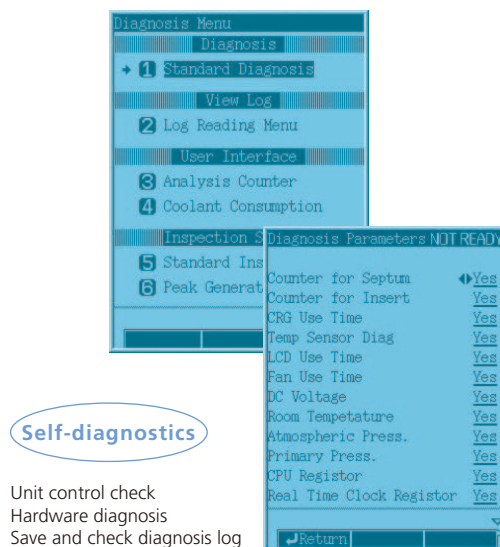
### Easy-to-understand Pop-up Screens

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



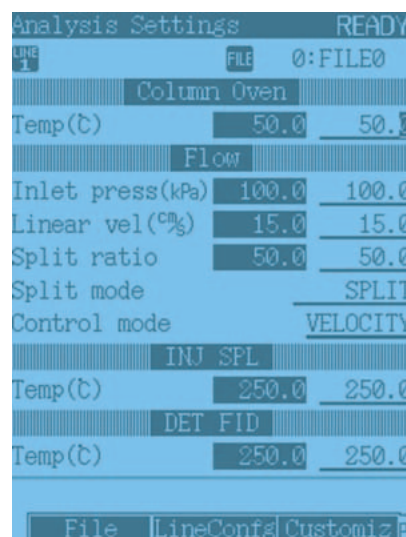
## Reduces unexpected downtime Intelligent Self-diagnostics

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.



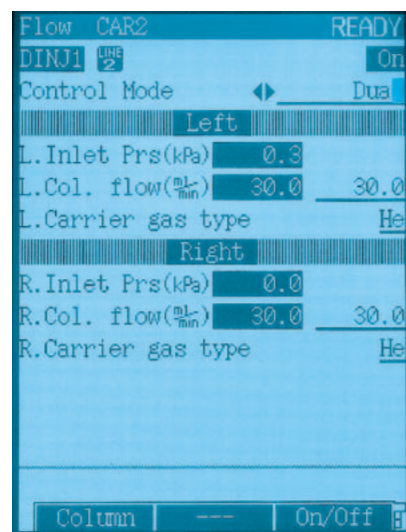
## Digital Control of Column Flow Rate and Split Ratio AFC (Advanced Flow Controller)

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

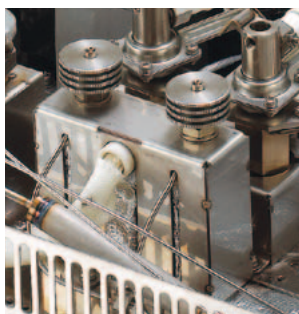
Obtaining better data requires that the appropriate column and sample introduction method be selected according to analytical objectives and samples to be

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.



#### Split/Splitless Injection Unit

**SPL-2014**

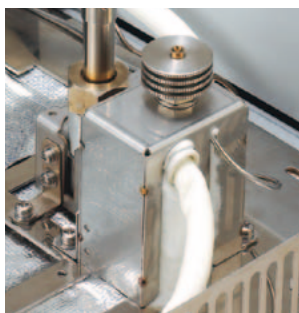
Standard unit for high-speed analysis with a narrow bore column. The gas saver function restricts the total gas used. High-pressure injection standard



#### Single Packed Injection Unit

**SINJ-2014**

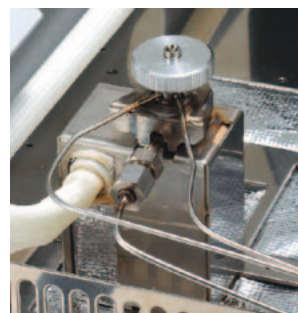
This is a specialized sample injection unit for use with ECD or other high sensitivity detectors.



#### 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.

#### Unit Addition

4 types of injection units

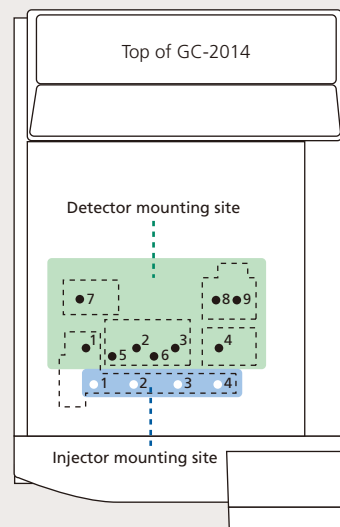
5 types of detectors

### Flexibility

#### Options after Installation

OPTION

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.

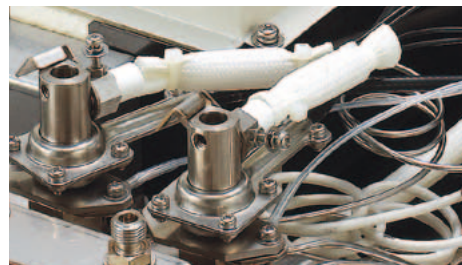
### Flame Ionization Detector

#### 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.

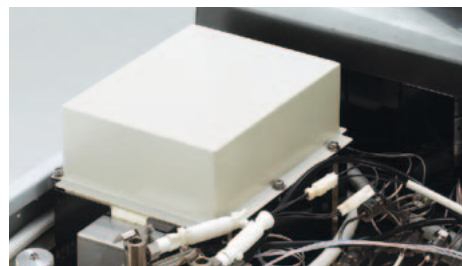
Single and dual FID's are available.



### 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 electrophilic 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.

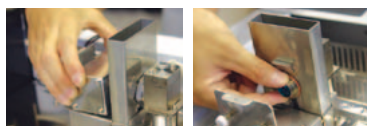


### Flame Photometric Detector

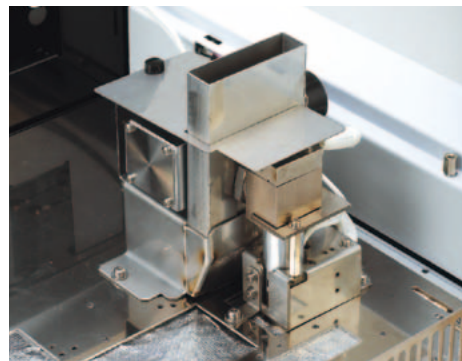
#### FPD-2014

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.



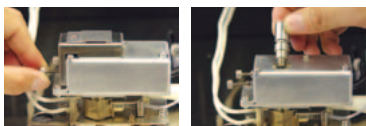
\*Filter replacement requires no tools.



## 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.



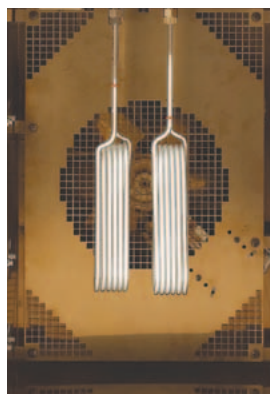
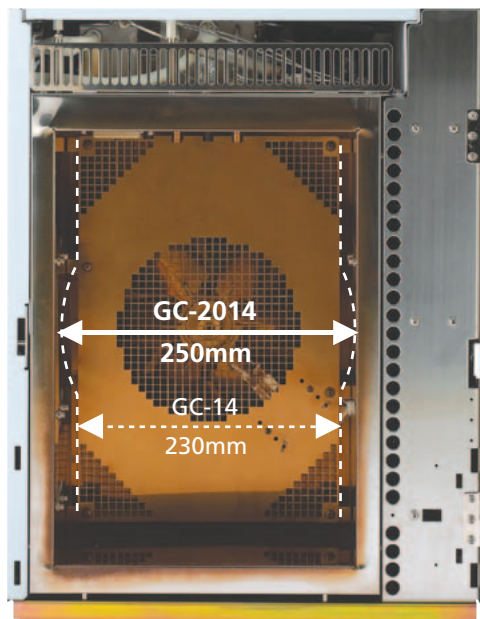
## Flexibility

# Effective Use of GC Series Column Resources

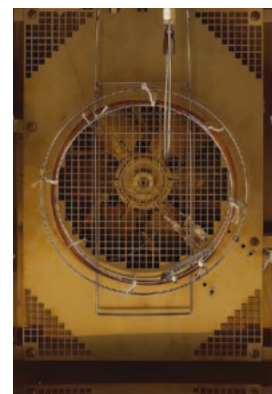
Effective use of valuable column resources is maintained by using the 40-mm-pitch glass column the same as Shimadzu GC-7, 9, 12, 14, 15 and 16 Series.

## Large Column Oven Facilitates Column Operations

Column replacement is easier by increasing the oven capacity while keeping its width the same.



Packed Column



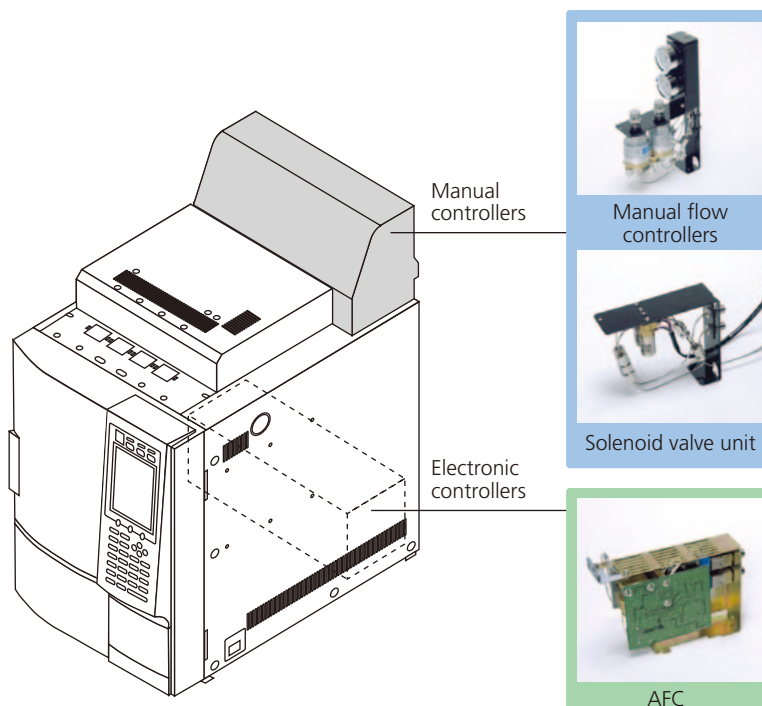
Capillary Column

Accommodates both packed and capillary columns.

## 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

### Distillation GC System

- 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 (Distillation GC)

- GC-2014 + WBI-2014 + GCsolution + distillation GC software  
(Select sample injection unit and column according to the target sample)

#### Analysis Applications

- Petroleum distillate



### PONA Analysis System

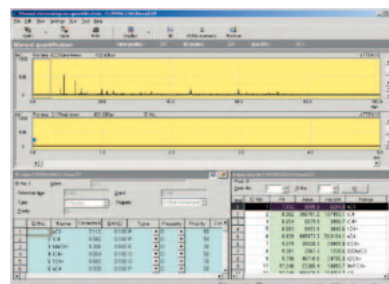
- Separates gasoline or other hydrocarbon compounds, identifies the peaks and classifies them by carbon number, or by type (paraffin, olefin, naphthene and aromatic series) for quantitation.

#### System Configuration (PONA GC)

- 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





# Specifications

Column Oven	
Temperature range	(Ambient + 10°C) ~ 400°C (using liquid CO <sub>2</sub> gas*: -50°C ~400°C)
Dimensions	250 (W) × 360 (H) × 175 (D) mm
Oven capacity	15.8L
Temperature accuracy	Set value (K) ± 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	9999.99 minutes max.
Linear heating range	30°C/min up to 150°C 20°C/min up to 250°C 10°C/min up to 380°C 7°C/min up to 400°C (at 25°C ambient temperature)
Cooling rate	300°C ~ 50°C in 6 min max. (at 25°C ambient temperature)
Columns accepted	Capillary columns: 2 Packed columns for GC14B: 4 (Glass columns: 2)

\*Optional parts are required to use liquid CO<sub>2</sub> 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, direct (AMC)

Carrier Gas Flow Controller	
<b>For Packed / Dual</b>	
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
<b>For Capillary Split/Splitless, Direct</b>	
<b>(Split/splitless injection mode)</b>	
Pressure setting range	0 ~ 970kPa
Programmable steps	7 (pressure-decreasing program possible)
Programmed rate setting range	-400 ~ 400kPa/min
Split ratio setting range	0 ~ 9999.9
Total flow rate setting range	0 ~ 1200mL/min
Correction function	Maintains column average linear velocity during column oven heating (for capillary only)
<b>(Pressure mode direct injection)</b>	
Pressure setting range	0 ~ 970kPa/min
Programmable steps	7
Programmed rate setting range	-400 ~ 400kPa/min
Correction function	Maintains column average linear velocity during column oven heating (for capillary only)
<b>(Flow-rate mode direct injection)</b>	
Flow rate setting range	0 ~ 1200mL/min
Programmable steps	7
Programmed rate setting range	-400 ~ 400mL/min
<b>For Single Packed, Direct (AMC)</b>	
Flow rate setting range	0~100mL/min
Correction function	Maintenance 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
<b>Flame Ionization Detector (FID)</b>	
System	Dual flow rate differential system
Temperature range	400°C max.
Minimum detected quantity	3pgC/s (dodecane)
Dynamic range	10 <sup>7</sup>
Nozzle	Quartz glass Standard: for packed, Option: for capillary
<b>Thermal Conductivity Detector (TCD)</b>	
System	Dual flow rate differential system
Temperature range	400°C max.
Dynamic range	10 <sup>5</sup>
Sensitivity	40,000mV · mL/mg (built-in pre-amplifier, with 10 × amplification)
<b>Electron Capture Detector (ECD)</b>	
System	Fixed current system using <sup>63</sup> Ni <sup>370</sup> MBq radiation source
Temperature range	400°C max.
Minimum detected quantity	0.1pg/s (γ-BHC)
Dynamic range	10 <sup>4</sup>
<b>Flame Photometric Detector (FPD)</b>	
Temperature range	350°C max.
Dynamic range	P: 10 <sup>4</sup> S: 10 <sup>3</sup>
Minimum detected quantity	P: 0.5pgP/s (tributyl phosphate) S: 8pgS/s (dodecane thiol)
<b>Flame Thermionic Detector (FTD)</b>	
	(Two types, one for capillary and one for packed. The specification are the same.)
Temperature range	400°C max.
Dynamic range	N: 10 <sup>3</sup> P: 10 <sup>3</sup>
Minimum detected quantity	N: 0.4pgN/s (azobenzene) P: 0.05pgP/s (malathion)

Display
240 × 320 dot graphics display (30 characters × 16 lines)

Dimensions, Weight, Power Requirements (GC main unit)	
Dimensions	400 (W) × 690 (H) × 607 (D) mm
Weight	48kg (GC-2014AF model)
Power Requirements	AC 100V/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

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.



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