



## Chromatec Crystal 9000 Laboratory Gas Chromatography System

### GC Chromatec-Crystal 9000

Crystal 9000 is a leading gas chromatograph in Chromatec GC product line. Crystal 9000 has highest performances and able to meet wide range of applications.

Crystal 9000 is fully automated, flexible, versatile instrument features a wide range of detectors, injectors and external automatic samplers and other devices.

#### Capability

Can install simultaneously :

- Four detectors
- Three injectors (third as Packed Column Inlet)
- Up to 13 heating zones
- Six gas valves
- Ten flow/pressure controllers
- Optional 7 inch Touch Screen LCD

Possibility to install a wide range of capillary pneumatic control accessories like Dean's switch microfluidic module and other low-dead volume collectors for capillary columns switching.

Fully controlled by PC software or by optional external keyboard/display.

Optional 7 inch Touch Screen LCD makes the operational more easier and helps to get fast information about instrument status.

#### Applications range

With wide range of detectors, injectors, valves in GC as well as many supplementary equipment, meets to a great deal of applications. Individual application testing of each GC at manufacturing, when turnkey solution is required, provides the best decision for the customer.

#### Versatility and Flexibility

Many detectors have the same seat, also injectors, valves, methanizer, other additional thermostatic options can be mounted into the same sockets. Based on such versatility C9000 can perform very complicated analyses as well as can be supplied as very simple GC possible to be upgraded in configuration for future applications.

Suggested GC platform includes digital flow and pressure controllers (DFPC) for gas feeding built-in units. Number of DFPCs is specified in ordering specification and determines GC platform price.

#### Easy changeable configuration:

System units and components are easy in operation and service. The instrument is suitable with routine and high throughput laboratories. The instrument configuration can be easily changed in minutes to respond to a specific work load by simply swapping injector or detector modules with pneumatic units. This unique structure of the systems lets customer get a maximum functionality by lowest cost.

### Crystal 9000 Chromatography System Performance\*:

Retention Time Repeatability:	<0.008% RSD or <0.0008 min SD
Peak Area Reproducibility:	< 1% RSD

\*Crystal 9000 GC with AS-2M autosampler, for Heptane sample  
Results may vary with different samples and conditions

### Column Oven:

Dimension (WxDxH):	250 mm x 165 mm x 290 mm	
Temperature range:	Standard mainframe	from 4 degrees above ambient to 450 °C
	with optional oven ventilation unit	from 3 degrees above ambient to 450 °C
	with optional cooling system	from -10° to 450 °C
Maximum Heating Rate:	Maximum settable	Up to 250 °C/min
	At linear heating range	Up to 130 °C/min
Cool down time from 400 to 50 °C:	Standard mainframe	5 min
	with optional oven ventilation unit	3.3 min
Temperature setpoint resolution:	0.1 °C	
Temperature accuracy:	0.02 °C	
Number of ramps and plateaus:	Unlimited	
Maximum run time, events time:	Unlimited	
Additional benefits:	"Rest Time" for column	
	Negative ramps are allowed	

### Unified Electronic Pneumatic Control (UEPC):

#### General Information:

Chromatec Crystal 9000 Electronic Pneumatic Control system contains unified digital flow controllers (DFC10) and digital pressure controllers (DPC11) are arranged for complete electronic gas management for all GC units.

Chromatec unified electronic pneumatic control has atmospheric temperature and pressure compensation to achieve maximum accuracy of gas pressure/flow providing. With digital gas control GC work becomes more accurate and flexible with many useful programmable functions based on DFPC such as flame ignition control, leak check, gas economy function, gas flow and pressure programming and others.

DFC10 unit – provides detectors, inlets split/purge line and other units by high accuracy gas flow.

DPC11 unit – has two modifications DPC11.A2 (with maximum pressure up to 440 kPa) and DPC11.h (with maximum pressure up to 1000 kPa) to provide inlet or any other units by high accuracy gas pressure with flow monitoring.

#### Unified Electronic Pneumatic Control - Carrier Gas Programming:

Pressure measuring unit:	kPa, psi
Working mode:	Constant pressure, constant flow, constant velocity
Number of pressure/flow program ramps:	Unlimited
Carrier gas type:	H <sub>2</sub> , He, Ar, N <sub>2</sub> , Air
Maximum pressure:	1050 kPa (152 psi)
Pressure setpoint resolution:	0.01 kPa (0.001 psi)
Pressure typical control:	± 0.01 kPa (0.001 psi)
Flow setpoint resolution:	0.1 mL/min

#### Unified Electronic Pneumatic Control – Capillary Inlet Gases:

Gas type:	H <sub>2</sub> , He, Ar, N <sub>2</sub> , Air
Maximum pressure:	1050 kPa (152 psi)
Total Flow:	1250mL/min

#### Unified Electronic Pneumatic Control – Detector Gases:

Gas type:	H <sub>2</sub> , He, Ar, N <sub>2</sub> , Air, Ar/CH <sub>4</sub>
Maximum flow range:	500 mL/min (standard), 1250 mL/min (optional)
Maximum flow range (Air):	800 mL/min
Flow setpoint resolution:	0.1 mL/min

## Inlets:

### Packed Column Inlet:

Separation Column Suitability:	Packed columns, micro-packed columns (standard) Widebore columns (with optional adapter)
Gas Control	Fully Automated
Maximum Temperature:	450 °C
Total Flow:	500 mL/min (standard), 1250mL/min (option)
Other Features:	Gas saver mode Inlet leak check

### Split/Splitless Inlet:

Separation Column Suitability:	Capillary columns (0.05...0.53mm I.D.)
Operating modes:	Split, Splitless, Pulsed Split, Pulsed Splitless
Maximum Temperature:	450 °C
Maximum Split Ratio:	12500:1
Maximum pressure:	1050 kPa (152 psi)
Total Flow:	1250mL/min
Electronic Septum purge flow:	Available as option
Other Features:	Gas saver mode Inlet leak check

### Programmable Split/Splitless Inlet:

Separation Column Suitability:	Capillary columns (0.05...0.53mm I.D.)
Operating modes:	Split, Splitless, Pulsed Split, Direct On-Column, Pulsed Splitless, Large Volume Injection
Maximum Temperature:	450 °C (standard) , 500 °C (option)
Programmable Temperature Range:	from +40 to 450°C (Fan cooling) from -70 to 450°C ( with LCO2 cryogenic option) from -160 to 450°C (with LN2 cryogenic option)
Max heating rate:	500 °C/min
Maximum Split Ratio:	12500:1
Cool down time:	from 350°C to 40°C : 7 min (fan cooling)
Maximum pressure:	1050 kPa (152 psi)
Total Flow:	1250mL/min
Septum purge flow:	By pressure regulator (standard), electronic control (option)
Other Features:	Gas saver mode Inlet leak check

## Additional Options:

Valves	Two-position 4, 6, 10-port rotary valves for sampling or switching. Heating range: up to 150°C – for Chromatec-made valves up to 225 °C or 330 °C for Valco valves. Various Valco valves can be integrated into GC as well. Valco valves have original electronic or pneumatic actuator.
Dean switcher	Multi-dimensional switching for capillary columns.
Solenoid valves	2-, 3-port solenoid valves for backflushing. Max 6 solenoid valves installed in GC
Methanizer	CO, CO2 conversion into CH4. Maximum temperature: 450°C
Auxiliary column thermostat	Modifications for packed or capillary columns are available. Temperature mode – isotherm.
Piston injector	Injection of liquefied samples under high pressure (up to 10 MPa) Sample volume – 0.25ul, 0.5ul, 1.2ul Max pressure – 10 MPa Max temperature (evaporation cell) – 400°C

## Detectors:

### Flame Ionization Detector (FID):

General uses:	sensitive to most organic compounds.
Separation Column Suitability:	Packed and Capillary
Minimum detectable level (MDL):	< 1.4 pgC/s (for propane or heptane)
Linear dynamic range:	> 10 <sup>7</sup>
Maximum Temperature:	450°C
Gas control:	Fully automated
Flame ignition/reignition:	Automatic
Data acquisition rate:	10...300 Hz

### Flame Photometric Detector (FPD):

General uses:	sensitive to sulfur- or phosphorus-containing compound.
Separation Column Suitability:	Packed and Capillary
Minimum detectable level (MDL):	<1pgS/s, <45fgP/s (for parathion methyl)
Linear dynamic range:	> 10 <sup>3</sup> (S), > 10 <sup>4</sup> (P)
Maximum Temperature:	400°C
Gas control:	Fully automated
Flame ignition/reignition:	Automatic
Data acquisition rate:	10...300 Hz
Operation modes:	S-mode or P-mode (depending on installed color filter)
FI sensor	Available as option.
Additional Features:	Linearization function

### Thermal conductivity detector (TCD):

General uses:	sensitive to all compounds, except carrier gas
Separation Column Suitability:	Packed (standard) , Capillary (option)
Minimum detectable level (MDL)	< 0.8 ng/mL (for propane or heptane)
Linear dynamic range:	> 10 <sup>5</sup>
Maximum Temperature:	350°C
Gas control:	Fully automated
Data acquisition rate:	10...300 Hz
Filament type:	Tungsten (standard), Gold-coated filaments (option)*

\*Other filament types are available through Chromatec Channel Partners

### Micro Thermal conductivity detector (μ-TCD):

General uses:	sensitive to all compounds, except carrier gas
Separation Column Suitability:	Capillary
Minimum detectable level (MDL):	< 1 ng/mL (for propane or heptane)
Linear dynamic range:	> 10 <sup>5</sup>
Maximum Temperature:	250°C
Gas control:	Fully automated
Data acquisition rate:	10...300 Hz
Filament type:	Tungsten (standard)*

\*Other filament types are available through Chromatec Channel Partners

### Electron-capture detector (ECD):

General uses:	specific detector to electrophilic compounds
Separation Column Suitability:	Packed (standard) , Capillary (option)
Minimum detectable level (MDL):	< 20 fg/s (for Lindane)
Linear dynamic range:	> 0.5x10 <sup>4</sup>
Maximum Temperature:	450°C
Gas control:	Fully automated
Data acquisition rate:	10...300 Hz

### Micro Electron-capture detector (μ-ECD):

General uses:	specific detector to electrophilic compounds.
Separation Column Suitability:	Capillary
Minimum detectable level (MDL)	< 4.4 fg/s (for Lindane)
Linear dynamic range:	> 0.5x10 <sup>4</sup>
Maximum Temperature:	450°C
Gas control:	Fully automated
Data acquisition rate:	10...300 Hz

**Nitrogen phosphorous detector (NPD):**

General uses:	Sensitive to nitrogen- or phosphorus-containing compounds.
Separation Column Suitability:	Packed and Capillary
Minimum detectable level (MDL) :	<0.02pgP/s (for parathion methyl) <0.2pgN/s (for azobenzene)
Linear dynamic range:	> 10 <sup>4</sup> (P), > 10 <sup>4</sup> (N)
Maximum Temperature:	450°C
Gas control:	Fully automated
Flame ignition/reignition:	Automatic
Data acquisition rate:	10...300 Hz

**Catalytic combustion detector (CCD):**

General uses:	for combustible gases (mostly used for hydrogen, CO, CH4 or oxygen traces determination)
Separation Column Suitability:	Packed (standards), Capillary (option)
Minimum detectable level (MDL)	< 0.8 ng/mL (for Hydrogen)
Linear dynamic range:	> 10 <sup>3</sup>
Maximum Temperature:	300°C
Gas control:	Fully automated
Flame ignition/reignition:	Automatic
Data acquisition rate:	10...300 Hz

**Photoionization detector (PID):**

General uses:	PID is specific to compound ionized under UV-light (typically unsaturated hydrocarbons, aromatics and others)
Separation Column Suitability:	Packed, Capillary
Minimum detectable level (MDL):	< 0.25 pg/s (for benzene)
Linear dynamic range:	> 10 <sup>7</sup>
Maximum Temperature:	250°C
Gas control:	Fully automated
Light Source:	Kr Lamp (10.6 eV)
Data acquisition rate:	10...300 Hz

**Pulsed discharge detector (PDD):**

General uses:	Operating as HID, PDD (model D2-220) is the most sensitive detector for permanent gas determination at ppb level.
Separation Column Suitability:	Packed, Capillary
Minimum detectable level (MDL):	< 0.3 ng/s
Linear dynamic range:	> 10 <sup>5</sup>
Maximum Temperature:	400°C
Gas control:	Fully automated
Flame ignition/reignition:	Automatic

**Mass Spectrometry Detector (MSD):**

General uses:	For qualitative and quantitative analysis of organic compound
Mass filter mode:	Single Quadruple
Ion Source:	EI (standard), CI (option)
Mass Range:	1–1200 amu with unit mass resolution
Electron Energy:	Adjustable from 0 eV to 130 eV
Max Scan Rate	20000 amu./s
Ion Source Temperature:	up to 350 °C
Transfer Line Temperature:	up to 400 °C
Sensitivity (EI):	S/N > 1500 : 1 (for 1uL injection of 1pg/uL OFN, SIM)
Mass Stability:	±0.1 a.m.u/48 h
Dwell time:	from 0.00005 to 300 s

\*Refer to MSD Technical Specification Sheet for more information

**Data System:**

Communication Interfaces:	LAN Ethernet (standard) USB (standard) RS 232 to PC (option) Analogue output (option) Start in, ready out (option)
Instrument keyboard and display:	- Touch screen LCD for control and monitoring (optional). - External keyboard with 4-line LCD display (optional).
Control, Data Acquisition and Analysis Software:	Chromatec Analytic © Originally developed software to provide a full control of all the instruments manufactured by Chromatec, not only gas chromatograph, but also a range of peripherals (liquid sampler, thermal desorber, headspace sampler. Chromatec Analytic SW is the powerful tool for data processing
Additional software:	Chromatec Gas, Chromatec DHA, Chromatec Energetics and other software solutions are available for additional calculation with Chromatec Analytic Software ©

**Environmental Conditions:**

Ambient Operating Temperature:	from 10 to 35°C
Relative humidity:	not more than 95 %
Atmospheric pressure	from 84 to 107 kPa
Storage Temperature:	from -50 °C to 40°C
Power Requirements:	~220V ±10%, 50 – 60 Hz
Power consumption:	2500W (Max at heating), 700W (average at isotherm)

**Other specification:**

Dimensions: (WxDxH);	520 mm x 590 mm x 540 mm
Weight:	49 kg

**Safety and Certification:**

Products designed and manufactured under regulations of GOST R ISO 9001 quality standard.  
At electromagnetic compatibility the chromatograph meets the requirements of IEC 61326-1.  
Structural safety of the chromatograph meets to requirements of GOST IEC 61010-1, GOST IEC 61010-2.  
CE Conformity Certificate approves the compliance of the instrument with essential safety requirements of the following EC New Approach Directives: 2004/95/EC Low Voltage Directive, 2004/108/EC EMC Directive.  
European harmonized standards used for the conformity assessment:  
EN61326-1:2013, EN 61010-1:2010, EN 61010-2-081:2002/A1:2003

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