

Clarus 500 Gas Chromatograph

The PerkinElmer® Clarus® 500 Gas Chromatograph (GC) is a fully automated gas chromatograph. The system offers the capabilities required for laboratories performing large numbers of routine analyses as well as those involved in research and development. All instrument functions are set up and monitored through a touch screen. The intuitive graphical user interface includes a real-time chromatogram display and eight-language support.

Oven

The Clarus 500 GC oven provides easy access to columns. The oven gives excellent temperature control and fast cool-down times for maximum productivity. All temperature and time functions are microprocessor controlled and are shown on the touch-screen display. Software selectable coolant time-out and coolant cut-in temperatures ensure economical subambient operation.

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|---------------------------|--|------------------|
| Volume: | 10,600 cm ³ | |
| Temperature range: | 10 °C above ambient to 450 °C or -99 °C to 450 °C with subambient accessory | |
| Column overheat protect: | User settable up to 450 °C | |
| Temperature programmer: | 3 ramp, 4 plateaus | |
| | Minimum Range | Increment |
| Initial oven temperature: | -99 °C to 450 °C | 1 °C |
| Initial time: | 0 to 999 min | 0.1 min |
| Rate: | 0.1 to 45 °C/min | 0.1 °C |
| Plateau time: | 0 to 999 min | 0.1 min |
| Final oven temperature: | -99 °C to 450 °C | 1 °C |
| Cool-down times: | 250 °C to 50 °C: 4.8 min 200 °C to 50 °C: 3.8 min 50 °C to 0 °C*: 2.6 min 50 °C to -30 °C*: 3.4 min *with liquid CO ₂ | |

Pneumatics

A full range of pneumatic options provides optimum performance with all types of columns and detectors. The Clarus 500 GC may be ordered with or without PPC (programmable pneumatic control). If the instrument is ordered with PPC, each injector or detector option may be ordered with conventional or PPC pneumatics. There are up to 12 PPC zones configured as 2 carrier (2 zones each), 2 detector (2 zones each) and 4 auxiliary channels.

Carrier gas pneumatics

- Carrier gas pneumatics are included with the Clarus 500 injector
- PPC or conventional pneumatics are available for all injectors
- Two carrier zones
- Carrier PPC zones compensate for variations in ambient temperature and pressure for maximum stability
- Split vent pneumatics are included with the Clarus 500 split/splitless and PSS (programmable split/splitless) injectors
- PPC provides direct setting of split flow rates and ratios
- Split vent PPC zones compensate for variations in ambient temperature for maximum stability
- PPC provides direct setting in mL/min, psig or kPa or cm/sec
- Automatic leak testing with PPC
- Three-ramps pressure program
- Pneumatic program rates:
 - 0-100.0 psi/min
 - 0-100.0 mL/min
 - 0-200.0 cm/sec
 - or ballistic

Detector pneumatics

- PPC or conventional pneumatics are available for all detectors (excluding Electrolytic Conductivity Detector [ELCD])

- Four detector pneumatic zones
- PPC provides direct setting in mL/min
- Detector PPC zones compensate for variations in ambient temperature for maximum stability

Auxiliary pneumatics

- Four auxiliary zones
- PPC provides direct setting in mL/min, psig or kPa
- Auxiliary PPC zones compensate for variations in ambient temperature for maximum stability

Autosampler

The Clarus 500 GC offers an optional, built-in syringe autosampler for maximum sampling capabilities. All control is accomplished through the keyboard or by a data system such as TotalChrom®.

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| Injection speed: | Normal, fast, slow |
| Program modes: | Two methods may be programmed |
| Number of sample positions: | 82, plus one priority |
| Vial size: | 2-mL (0.25 mL with insert) crimp-top caps 2-mL screw-top caps |
| Number of waste and wash vials: | Four waste and four wash |
| Waste and wash vial size: | 4 mL |
| Syringe size: | 0.5 µL, 5.0 µL or 50.0 µL |
| Sampling volume: | 0.1 µL to 0.5 µL from the 0.5-µL syringe in 0.1-µL increments or 0.5 µL to 5.0 µL from the 5.0-µL syringe in 0.5-µL increments or 5.0 µL to 50.0 µL from the 50.0-µL syringe in 5.0-µL increments |
| Viscosity settings: | 0-15 |
| Maximum number of injections/vial: | 15 |
| Maximum number of solvent postwashes: | 15 |
| Maximum number of sample pumps: | 15 |
| Maximum number of sample prewashes: | 15 |
| Minimum sample volume required: | 5 µL when used with the 0.25-mL vial insert; 350 µL when used with the 2-mL vial |
| Reproducibility: | < 0.5% RSD for packed columns 1% C9 in C7, 1 µL injected |

Injectors

The Clarus 500 GC supports a comprehensive array of injectors that provides accuracy and precision to all of your sampling applications. Up to two injectors may be installed and operated simultaneously with independent temperature control. Every injector is available with PPC or conventional pneumatics.

Packed-column injector

- Removable glass liner for trapping nonvolatile residues
- Adapter for on-column injection to wide-bore capillary columns
- 50 °C to 450 °C in 1 °C increments
- 1/8-inch fitting
- 1/4-inch column adapter available
- Conventional pneumatics – choice of flow controller with head-pressure gauge, or flow controller with head-pressure gauge and digital display of flow
- PPC pneumatics – programmed flow or pressure includes readout which displays pressure or column flow

Split/splitless capillary injector

- Split ratio easily adjustable for a wide range of analysis conditions
- Charcoal trap in split vent prevents contamination of split valve and lab air
- Two choices of liner: 2-mm and 4-mm internal diameter
- 50 °C to 450 °C in 1 °C increments
- 1/16-inch fitting
- Conventional pneumatics – pressure regulator (0-60 psig) for digital display of column head pressure. Automatic control of split vent solenoid valve
- PPC pneumatics – four software configurable modes: programmed flow, programmed pressure, programmed velocity or constant flow. Vacuum compensation software selectable
- PPC pneumatics include automatic control of split vent by split flow or split ratio

Programmable on-column capillary injector

- Temperature-programmable inlet
- Three-ramps temperature program
- Oven tracking mode for simple operation
- 50 °C to 500 °C in 1 °C increments
- Heating rate of 1 °C/min to 200 °C/min or ballistic
- 1/16-inch fitting

- Conventional pneumatics – choice of flow controller with head-pressure gauge, or flow controller with head-pressure gauge and digital display of flow
- PPC pneumatics include readout which displays pressure and column flow

PSS – programmable split/splitless capillary injector

- Temperature-programmable inlet
- Large-volume injection of up to 50 µL with autosampler, 150 µL manually
- Three-ramps temperature program
- Oven tracking mode for simple operation with on-column injection
- Split ratio easily adjustable for a wide range of analysis conditions
- Three choices of liner available: 1-mm and 2-mm i.d. and on-column
- Charcoal trap in split vent prevents contamination of split valve and lab air
- 50 °C to 500 °C in 1 °C increments
- Heating rate of 1 °C/min to 200 °C/min or ballistic
- 1/16-inch fitting
- Conventional pneumatics – pressure regulator (0-60 psig) for digital display of column head pressure. Automatic control of split vent solenoid valve
- PPC pneumatics – four software configurable modes: programmed flow, programmed pressure, programmed velocity or constant flow. Vacuum compensation software selectable
- PPC pneumatics include automatic control of split vent by split flow or split ratio

PreVent

- Unique PerkinElmer sample management system
- Available only on the Clarus 500 GC with PSS or split/splitless capillary injector and PPC pneumatics
- Includes injector and detector restrictors
- PreVent™ time-saver mode prevents higher boiling components or residues from going through the column and the detector.
- PreVent enhanced large-volume injection (ELVI) mode isolates the column and detector from the effects of high levels of solvent. Eliminate solvent flooding of the column or allow the use of solvents such as methylene chloride with an ECD.

- PreVent isolation mode allows a septum change without interrupting carrier flow. Perform maintenance on the inlet WHILE chromatography is taking place.
- ProTect mode eliminates contamination by preventing heavy components in the sample from reaching the expensive and retentive chromatographic column. Allows back flushing during chromatographic run.
- MSVent™ mode allows changing of columns without cooling and venting the Clarus 500 MS, reducing instrument downtime, offering a significant time savings. In addition, MSVent facilitates connection of the vent to a second detector for dual signal capability, providing greater flexibility and enhancing productivity.

Gas sampling valves

- Wide offering of 4-, 6-, 8- and 10-port valves
- Large range of valved systems and standard analyzers available
- Keyboard controlled
- 1/16- or 1/8-inch fittings

Detectors

A wide choice of detectors optimized for sensitivity and selectivity is available for use with the Clarus 500 GC. All built-in detectors include an automated background compensation feature that corrects for column bleed. Whether you choose the Flame Ionization Detector, the Thermal Conductivity Detector, the Electron Capture Detector, and/or environmental-specific detectors, all conform to the highest industry standards for reliability and performance. Every detector except the Electrolytic Conductivity Detector (ELCD) is available with PPC or conventional pneumatics. Up to two detector modules may be installed and operated simultaneously with independent temperature and pneumatic control.

Flame Ionization Detector (FID)

- Wide linear dynamic range
- No makeup gas required due to efficient sweeping of column effluent by hydrogen combustion gas
- Air flow designed to minimize contamination and residue buildup
- 1/8-inch fittings
- Conventional pneumatics – pressure regulator for hydrogen, needle valve for air
- PPC pneumatics – software flow control of hydrogen and air
- “Flame out” warning and ready interlock

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| Operating temperature: | 100 °C to 450 °C in 1 °C increments |
| Sensitivity: | > 0.015 coulombs/g C |
| Minimum detectable quantity: | < 3 • 10 ⁻¹² g C/sec nonane at a S/N = 2 to 1 |
| Linearity: | > 10 ⁶ |
| Signal filtration: | 50, 200, 800 msec |
| Input range: | 1, 20 |
| Makeup gas: | Not required |

Electron Capture Detector (ECD)

- High sensitivity
- Excellent selectivity
- High operating temperature for maximum stability
- 1/8-inch fittings
- Conventional pneumatics – needle valve for makeup gas
- PPC pneumatics – software flow control of makeup gas

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|------------------------------|--|
| Source: | 15 mCi ⁶³ Ni |
| Temperature protect: | 470 °C by software |
| Carrier gas: | Either Ar/CH ₄ or N ₂ |
| Operating temperature: | 100 °C to 450 °C in 1 °C increments |
| Minimum detectable quantity: | < 0.05 pg perchloroethylene with argon/methane or nitrogen |
| Linearity: | > 10 ⁴ |
| Signal filtration: | 200, 800 msec |
| Makeup gas: | Standard |

Thermal Conductivity Detector (TCD)

- Capillary-column compatible
- Proven constant current design
- Software protection to prevent filament burnout
- Ideal for series operation
- 1/8-inch fittings
- Conventional pneumatics – reference gas flow controller
- PPC pneumatics – software flow control of reference gas

| | |
|------------------------------|--|
| Operating temperature: | 100 °C to 350 °C in 1 °C increments |
| Sensitivity: | 9 µV/ppm nonane at 160 mA at the bridge with a detector temperature of 100 °C |
| Minimum detectable quantity: | Typically < 1 ppm nonane |
| Linearity: | > 10 ⁵ |
| Power supply: | Constant current with four selectable settings: 1: ±40 mA 2: ±80 mA 3: ±120 mA 4: ±160 mA |
| Signal filtration: | 50, 200, 800 msec |
| Filament protection: | Self-limiting and resetting after transient overloads in either channel |
| Makeup gas: | Not required for 0.32- to 0.53-mm i.d. columns with flows ≥ 5 mL/min Required for 0.25-mm or smaller i.d. columns |

Photoionization Detector (PID)

Special detector for water pollution analysis of samples containing aromatic compounds.

- Internal power supply and lamp control
- Series operation kit available
- Can be combined with ELCD in a single detector position
- 1/8-inch fittings
- Conventional pneumatics – needle valve for makeup gas
- PPC pneumatics – software flow control of makeup gas

| | |
|------------------------------|---|
| Operating temperature: | 100 °C to 250 °C in 1 °C increments (can be set to 350 °C for cleaning) |
| Minimum detectable quantity: | < 10 pg benzene |
| Linearity: | > 10 ⁷ |
| Signal filtration: | 50, 200, 800 msec |
| UV source lamp: | 10.2 eV |
| Input range: | 1, 20 |
| Makeup gas: | Standard |

Combination PID/ELCD

Specific detector for halogenated compounds.

- Clarus 500 GC controls solenoid valve for venting
- Combined with PID in a single detector position
- 1/8-inch fittings
- Conventional pneumatics – pressure regulator for hydrogen reaction gas

Operating temperature: 100 °C to 450 °C in 1 °C increments

Sensitivity: $5 \cdot 10^{-13}$ g Cl/sec trihalomethanes

Linearity: $> 10^6$

Signal filtration: 50, 200, 800 msec

Selectivity: $> 10^6$ (Cl:Hydrocarbon)

Makeup gas: Required for flows < 5 mL/min

Nitrogen Phosphorus Detector (NPD)

- Modular design
- Change bead in less than one minute
- Prealigned bead
- Rapid conditioning, up and running in less than two hours
- 1/8-inch fittings
- Conventional pneumatics – pressure regulator for hydrogen, needle valve for air
- PPC pneumatics – software flow control of hydrogen and air

Operating temperature: 100 °C to 450 °C in 1 °C increments

Minimum detectable quantity: $5 \cdot 10^{-13}$ g N/sec
2,4-dimethylaniline
 $5 \cdot 10^{-14}$ g P/sec tributylphosphate

Linearity: $> 10^4$

Signal filtration: 50, 200, 800 msec

Selectivity: 50,000:1 (N/C)
10:1 (P/N)

Input range: 1, 20

Makeup gas: Not required

Flame Photometric Detector (FPD)

- Clarus 500 GC software controls photo-multiplier tube voltage
- Clarus 500 GC software linearizer for sulfur mode
- 1/8-inch fittings
- Conventional pneumatics – needle valve for hydrogen, pressure regulator for air
- PPC pneumatics – software flow control of hydrogen and air

Operating temperature: 250 °C to 450 °C in 1 °C increments

Minimum detectable quantity: $1 \cdot 10^{-11}$ g S/sec thiophene
 $1 \cdot 10^{-12}$ g P/sec tributylphosphate

Linearity: Sulfur 10^2 (log-log)
Phosphorus 10^3

Signal filtration: 50, 200, 800

Selectivity: 10,000:1 (S/C)
100,000:1 (P/C)

Makeup gas: Not required

Touch-screen graphical user interface

The touch-screen graphical user interface incorporates a number of key features:

- Multi-language support (i.e. English, French, Italian, German, Spanish, Japanese, Chinese and Russian)
- Real-time graphic display of chromatogram
- Injection countdown for manual injections
- Column pressure/flow/velocity calculator
- More upgradable firmware
- Preventative maintenance counter
- Password protection
- Graphical display of temperature and pneumatic programs
- Status-summary screen
- Log file
- Resolution: 240 x 320
- 256-color display
- Meaningful error/alarm messages

Other Clarus 500 GC features

- Recorder attenuation range from 1 to 65,536 in binary steps
- Long-term battery backup of GC methods, autosampler programs, flow and temperature-calibration data
- Software calibration of oven temperature and carrier gas flow with PPC and conventional pneumatics
- Full instrument control via external computer
- Five stored methods
- Baseline compensation
- Auxiliary heated zone for accessory devices

Physical details

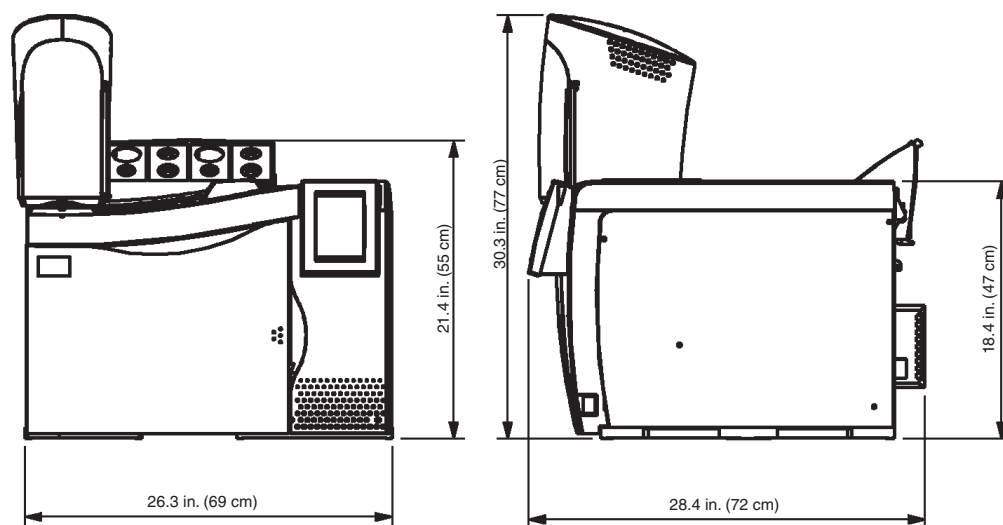
Power requirements: 120 V \pm 10%, 50/60 Hz, 2.0 kVA*
230 V \pm 10%, 50/60 Hz, 2.0 kVA
* On an independent 20-amp line

Ambient temperature: 10 °C to 32 °C

Ambient humidity: 80% maximum relative humidity without condensation

Mean BTU output: 3400

Weight
GC: 49 kg (108 lb)
Autosampler: 4.5 kg (10 lb)



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