



Agilent 7890A Network Gas Chromatograph

Data Sheet



Chromatographic Performance*

- Retention time repeatability
 $< 0.008\%$ or < 0.0008 min
- Area repeatability $< 1\%RSD$

The Agilent 7890A is a state-of-the-art gas chromatograph that provides superior performance for all applications. Key to its performance is the use of advanced electronic pneumatic control (EPC) modules and high performance GC oven temperature control. Each EPC unit is optimized for its intended use with a specific inlet and detector option.

GC oven temperature control of the 7890A oven allows for fast and precise temperature ramping. Overall thermal performance provides optimal chromatography including peak symmetry, retention time repeatability, and retention index accuracy.

The combination of precise pneumatic and temperature control leads to

extremely precise retention time reproducibility, which is the basis for all chromatographic measurement.

Agilent's proprietary Capillary Flow Technology provides a new dimension in chromatography with reliable, leak-free, in-oven capillary connections that stand up to repeated GC oven cycling over time. The 7890A GC has enhanced firmware to extend Capillary Flow capabilities and enhanced datasystem software to simplify set-up and operation of backflush. These new tools make it easier to analyze complex matrices and unknowns, and provide gains in productivity and data integrity for routine analyses via 2-dimensional heart cutting, detector splitting, and column backflushing.

The 7890A GC has advanced built-in capabilities to monitor system resources (counters, electronic logs and diagnostics). Agilent GC systems are known for their reliability, ruggedness, and long life. The Agilent 10-year use

guarantee provides greater assurance for a low-cost of ownership throughout the GC's life.

System Capabilities

- Supports simultaneously:
 - Two inlets
 - Three detectors (third detector as TCD)
 - Four detector signals
- State-of-the-art detector electronics and the full-range digital data path enable peaks to be quantified over the entire concentration range of the detector (10^7 for the FID) in a single run.
- Full EPC is available for all inlets and detectors. Control range and resolution are optimized for the specific inlet or detector module.
- Up to six EPC modules can be installed, providing control of up to 16 channels of EPC.

*Using 7890A with EPC (splitless), ALS and Agilent Data System for analysis of tetradecane (2 ng to the column). Results may vary with other samples and conditions.



Agilent Technologies

- Pressure setpoint and control precision to 0.001 psi provides more retention time locking precision for low-pressure applications.
- EPC with capillary columns provides four column flow control modes: constant pressure, ramped pressure (3 ramps), constant flow, or ramped flow (3 ramps). Column average linear velocity is calculated.
- Atmospheric pressure and temperature compensation is standard, so results do not change, even when the laboratory environment does.
- Low Thermal Mass (LTM) system can be added to achieve fastest cycle times via rapid LTM capillary column module heating and cooling.
- The LAN interface allows real-time monitoring of the GC when it is connected with Lab Monitor & Diagnostic Software, even when also connected to a data system.
- One-button access to maintenance and service modes from the keyboard
- Preprogrammed leak tests
- Automatic Liquid Sampling is fully integrated into mainframe control.
- Setpoint and automation control can be done from the local keyboard or via a networked data system. Clock-time programming can be initiated from the front panel to initiate events (on/off, method start, etc.) at a future date and time.
- A run time deviation log is created for each analysis to ensure that all method parameters were achieved and maintained.
- A full array of traditional gas sampling and column switching valves are available
- 550 timed events
- Display of all GC and ALS setpoints at the GC or data system.
- Context-sensitive online help
- Maximum run time: 999.99 min (16.7 h).
- Oven cool down (22 °C ambient) 450 to 50 °C in 4.0 min (3.5 min with oven insert accessory).
- Ambient rejection: < 0.01 °C per 1 °C.

Column Oven

- Dimensions: 28 × 31 × 16 cm. Accommodates up to two 105 m × 0.530 mm id capillary columns or two 10-ft glass packed columns (9 in. coil diameter, 1/4 in. od), or two 20-ft stainless steel packed columns (1/8 in. od).
- Operating temperature range suitable for all columns and chromatographic separations. Ambient temperature +4 °C to 450 °C.
 - With LN₂ cryogenic cooling: -80 to 450 °C.
 - With CO₂ cryogenic cooling: -40 to 450 °C.
- Temperature setpoint resolution: 0.1 °C.
- Supports 20 oven ramps with 21 plateaus. Negative ramps are allowed.
- Maximum achievable temperature ramp rate: 120 °C/min (120 V units are limited to 75 °C/min, see Table 1).

Electronic Pneumatics Control (EPC)

- Compensation for barometric pressure and ambient temperature changes is standard.
- Pressure setpoints may be adjusted by increments of 0.001 psi, with typical control ± 0.001 for the range 0.000 to 99.999 psi; 0.01 psi for the range 100.00 psi to 150.00 psi
- User may select pressure units as psi, kPa, or bar.
- Pressure/flow ramps: Three maximum.
- Carrier and makeup gas settings selectable for He, H₂, N₂, and argon/methane.
- Flow or pressure setpoints for each inlet or detector parameter with both Agilent 7890A and Agilent ChemStations.
- Constant flow mode is available when capillary column dimensions are entered into the 7890A.
- Split/splitless, Multimode, and PTV inlets have flow sensors for the control of split ratio.
- Inlet modules
 - Pressure sensors: Accuracy: < ± 2% full scale, Repeatability: < ± 0.05 psi, Temperature coefficient: < ± 0.01 psi/°C, Drift: < ± 0.1 psi/6 months.
- Flow sensors: Accuracy: < ± 5% depending on carrier gas, Repeatability: < ± 0.35% of setpoint,

Table 1. Typical 7890A GC Oven Ramp Rates

| Temperature range (°C) | 120 V Oven* rates (°C/min) | Fast ramp rates** (°C/min) Dual-Channel | Fast ramp rates** (°C/min) Single-Channel*** |
|------------------------|----------------------------|--------------------------------------------|-------------------------------------------------|
| 50 to 70 | 75 | 120 | 120 |
| 70 to 115 | 45 | 95 | 120 |
| 115 to 175 | 40 | 65 | 110 |
| 175 to 300 | 30 | 45 | 80 |
| 300 to 450 | 20 | 35 | 65 |

* Results obtained with line voltage maintained at 120V

** Fast ramp rates require power > 200 volts at > 15 Amps.

***Requires G2646-60500 oven insert accessory.

Temperature Coefficient
 $< \pm 0.20 \text{ mL/min (NTP)* per } ^\circ\text{C}$ for He or H₂; $< \pm 0.05 \text{ mL/min NTP per } ^\circ\text{C}$ for N₂ or Ar/CH₄.

- Detector modules:
Accuracy: $< \pm 3 \text{ mL/min NTP}$ or 7% of setpoint, Repeatability: $< \pm 0.35\%$ of setpoint

*NTP = 25 °C and 1 atmosphere

Inlets

- Maximum of two inlets installed
- EPC compensated for atmospheric pressure and temperature variation
- Inlets available:
 - Packed purged injection port (PPIP)
 - Split/splitless capillary inlet (S/SL)
 - Multimode inlet
 - Temperature-programmable cool on-column (PCOC)
 - Programmable temperature vaporizer (PTV)
 - Volatiles inlet (VI)

S/SL

- Suitable for all capillary columns (50 µm to 530 µm id).
- Split ratios up to 7,500:1 to avoid column overload. Setting split ratios (particularly low split ratios) is limited by column parameters and control of system flows (particularly low system flows).
- Splitless mode for trace analysis. Pressure-pulsed splitless is easily accessible for best performance.
- Maximum temperature: 400 °C.
- EPC available in two pressure ranges: 0 to 100 psig (0 to 680 kPa) for best control for columns $\geq 0.200 \text{ mm diameter}$; 0 to 150 psig for columns $< 0.200 \text{ mm diameter}$.

- Gas saver mode to reduce gas consumption without compromising performance.
- Electronic septum purge flow control to eliminate "ghost" peaks.
- Total flow setting range:
0 to 200 mL/min N₂
0 to 1,250 mL/min H₂ or He
- Turn top inlet sealing system is built in standard with each 7890A S/SL inlet for quick, easy, injector liner changes

Multimode Inlet

- Provides the flexibility of a standard Agilent split/splitless inlet, combined with temperature programmable capabilities which allow for large volume injection. Also supports cool injections for improved signal response.
- Temperature control: LN₂ (to -160 °C), LCO₂ (to -70 °C), air cooling (to ambient +10 °C with oven temperature < 50 °C) (due to high consumption, air cooling with cylinders is not advised). Temperature programming of up to 10 ramps at up to 900 °C/min. Maximum temperature: 450 °C.
- Injection modes:
 - Hot or cold split/splitless
 - Pulsed split/splitless
 - Solvent vent
 - Direct
- Suitable for all capillary columns (50 µm to 530 µm)
- EPC pressure range (psig): 0 to 100 psig
- Split ratio: up to 7500 to 1 to avoid column overload. Setting split ratios (particularly low split ratios) is limited by column parameters and control of system flows (particularly low system flows).
- Splitless mode for trace analysis. Pressure pulsed splitless is easily

accessible for improved performance.

- Electronic septum purge flow control
- Compatible with Merlin Microseal septum
- Setup of parameters facilitated with Agilent Solvent Elimination Calculator
- Total flow setting range:
 - 0 to 200 mL / min N₂
 - 0 to 1,250 ml/min H₂ or He
- Turn-top inlet sealing system is built in standard with each 7890A Multimode inlet for quick, easy injector liner changes

PCOC

- Direct injection onto cool capillary column ensures quantitative sample transfer with no thermal degradation.
- Automatic liquid injection supported directly onto columns $\geq 0.250 \text{ mm id}$.
- Maximum temperature: 450 °C. Temperature programming in 3 ramps or tracking oven. Subambient control to -40 °C is optional.
- Electronic pressure control range: 0 to 100 psig.
- Electronic septum purge flow control.
- Optional solvent vapor exit for large-volume injections.
 - Electronically controlled, inert, three-way valve allows solvent venting.
 - Includes software for method optimization.
 - Preassembled retention gaps/vent line/analytical column for easy installation.

PPIP

- Direct injection onto packed and wide-bore capillary columns.
- Electronic flow/pressure control: 0 to 100 psig pressure range, 0.0 to 200.0 mL/min flow range. Ranges are chosen to provide optimum performance over normal packed column setpoint ranges.
- Electronic septum purge flow control.
- 400 °C maximum operating temperature.
- Adapters included for 1/4-in. and 1/8-in. packed columns, and 0.530-mm capillary columns.

PTV

- Supports hot/cold split and splitless modes as well as large volume injections.
- Temperature control: either LN₂ (to -160 °C) or LCO₂ (to -65 °C) cooling. Temperature programming of up to 3 ramps at up to 720 °C/min. Maximum temperature: 450 °C.
- EPC pressure range 0 to 100 psig.
- Split ratio up to 7,500:1. Setting split ratios (particularly low split ratios) is limited by column parameters and control of system flows (particularly low system flows).
- Electronic septum purge flow control.
- Choice of Gerstel septumless head or Merlin Microseal® septum head.
- 450 °C maximum operating temperature.
- Total flow setting range:
 - 0 to 200 mL/min N₂
 - 0 to 1,250 mL/min H₂ or He

VI

- Very low volume (32 µL) interface suitable for gas or prevaporized samples. Recommended for use with

headspace, purge and trap, or thermal desorption samplers.

- Three modes for optimized sample introduction: split (up to 100:1 split ratio), splitless, and direct.
- Optimized EPC (H₂ or He carrier, 0.00 to 100 psig pressure control, 0.0 to 100 mL/min flow control).
- Electronic septum purge flow control.
- Silcosteel® treated flow path provides inert surface for minimum component adsorption.
- Maximum temperature: 400 °C.

Detectors

- Electronic pneumatics control and electronic on/off for all detector gases.
- EPC compensated for atmospheric pressure and temperature variation.

Detectors available:

FID

- Flame ionization detector (FID) that responds to most organic compounds.
- Minimum detectable level (for tridecane): < 1.5 pg C/s
- Linear dynamic range: >10⁷ (± 10%). Full-range digital data path enables peaks to be quantified over the entire 10⁷ concentration range in a single run.
- Data rates up to 500 Hz accommodate peaks as narrow as 10 msec at half height.
- Standard electronic pneumatic control for three gases:
 - Air: 0 to 800 mL/min
 - H₂: 0 to 100 mL/min
 - Makeup gas (N₂ or He): 0 to 100 mL/min
- Available in two versions: capillary column optimized or adaptable for either packed or capillary columns.

- Flameout detection and automatic reignition
- 450 °C maximum operating temperature

TCD

- Thermal conductivity detector (TCD), a universal detector that responds to all compounds, excluding the carrier gas.
- Minimum detectable level: 400 pg tridecane/mL with He carrier. (This value may be affected by laboratory environment).
- Linear dynamic range: > 10⁵ ± 5%
- Unique fluidic switching design provides rapid stabilization from turn-on, low-drift performance.
- Signal polarity can be run-programmed for components having higher thermal conductivity than the carrier gas.
- Maximum temperature: 400 °C
- Standard EPC for 2 gases (He, H₂, or N₂ matched to carrier gas type)
- Make-up gas: 0 to 12 mL/min
- Reference gas: 0 to 100 mL/min
- The 7890A GC can accommodate a third detector as TCD located on the left-hand side of the GC.

Micro-ECD

- Micro-electron capture detector (micro-ECD), a very sensitive detector for electrophilic compounds such as halogenated organic compounds.
- Minimum detectable level: < 5.5 fg/mL lindane At standard checkout conditions, with a detector temperature of 300 °C and flow to the detector (makeup plus column) of 30 mL/min, this is equivalent to 5.5 fg/sec.
- Proprietary signal linearization. Linear dynamic range: > 5 × 10⁴ with lindane
- Data acquisition rate: up to 50 Hz

- Uses β emission of < 15 mCi ^{63}Ni as the electron source.
- Unique micro-cell design minimizes contamination and optimizes sensitivity.
- 400 °C maximum operating temperature
- Standard EPC makeup gas types: argon/5% methane or nitrogen; 0 to 150 mL/min

NPD

- Nitrogen-phosphorus detector (NPD), a detector specific to nitrogen or phosphorus-containing compounds.
- NPD available with one of two beads, Blos (glass) bead or white ceramic bead (legacy offering)

Compared to the legacy white ceramic bead, the Blos bead offers:

 - Longer lifetime
 - More stable operation during the bead's lifetime
- MDL: < 0.1 pg N/s, < 0.03 pg P/s with azobenzene/malathion/octadecane mixture with Blos bead
- MDL: < 0.4 pg N/s, < 0.2 pg P/s with azobenzene/malathion/octadecane mixture with white ceramic bead
- Dynamic range: > 10^5 N, > 10^5 P with azobenzene/malathion mixture with Blos or white ceramic bead
- Selectivity: 25,000 to 1 g N/g C, 200,000 to 1 g P/g C with azobenzene/malathion/octadecane mixture with Blos bead
- Selectivity: 25,000 to 1 g N/g C, 75,000 to 1 g P/g C with azobenzene/malathion/octadecane mixture with white ceramic bead
- Data acquisition rate: up to 200 Hz
- Standard EPC for three gases:
 - Air: 0 to 200 mL/min

- H₂: 0 to 30 mL/min
- Makeup gas: 0 to 100 mL/min
- Available for packed/capillary columns or optimized for capillary columns
- 400 °C maximum operating temperature

FPD

- Single-wavelength flame photometric detector (FPD), or dual-wavelength flame photometric detector (DFPD) – a sensitive, specific detector to sulfur- or phosphorus-containing compounds.
- MDL: < 60 fg P/s, < 3.6 pg S/s with methylparathion
- Dynamic range: > 10^3 S, 10^4 P with methylparathion
- Selectivity: 10^6 g S/g C, 10^6 g P/g C
- Data acquisition rate: up to 200 Hz
- Standard EPC for three gases:
 - Air: 0 to 200 mL/min
 - H₂: 0 to 250 mL/min
 - Makeup gas: 0 to 130 mL/min
- Available in single- or dual-wavelength versions.
- 250 °C maximum operating temperature
- Agilent 7890A GC's ability to handle 4 signals allows simultaneous use of DFPD, top-mounted GC detector, and TCD.

SCD (Model 355)

- Highest sensitivity and selectivity for sulfur-containing compounds.
- MDL: Typical < 0.5 pg/s, dimethyl sulfide in toluene
- Linear dynamic range: > 10^4
- Selectivity: > 2×10^7 g S/g C

NCD (Model 255)

- High selectivity for nitrogen-containing compounds.

- MDL: < 3 pg N/s, in both N and nitrosamine modes, 25 ppm N as nitrobenzene in toluene
- Linear dynamic range: > 10^4
- Selectivity: > 2×10^7 g N/g C (selectivity in nitrosamine mode is matrix dependent)

See Agilent Sulfur Chemiluminescence Detector and Nitrogen Chemiluminescence Detector Specification Guide for additional information regarding performance and physical and environmental specifications.

MSD

See 5975 Series MSD specifications. See 7000A Triple Quadrupole GC/MS specifications.

Specialized detectors are available through Agilent Channel Partners including: atomic emission, helium ionization, and pulsed discharge ionization.

Auxiliary EPC Devices

The 7890A GC has two positions for auxiliary EPC devices located on the back of the GC. Each position can be any combination of auxiliary EPC or pneumatics control module.

Note: The communication for a third detector as TCD EPC module (located on the left side of the GC) interfaces via one of these auxiliary EPC module positions. If a third detector (TCD) is installed, one of these auxiliary positions is thus taken.

Auxiliary EPC Module

- Three channels of pressure control
- EPC compensated for atmospheric pressure and temperature variation when connected to a user-defined capillary column
- Psig (gauge) and psia (absolute) pressure control

- Forward pressure regulated
- Maximum of 2 auxiliary EPC modules per GC

Pneumatics Control Module (PCM)

- 2 channels for operation
- EPC compensated for atmospheric pressure and temperature variation when connected to a user-defined capillary column
- First channel:
 - Pressure or flow control
 - Psig (gauge) and psia (absolute) pressure control
 - Forward pressure regulated
- Second channel:
 - Pressure control
 - Psig (gauge) and psia (absolute) pressure control
 - Forward pressure or back pressure regulated
- PCM can be located in either/both inlet EPC positions, and in either/both auxiliary positions on the back of the 7890A GC
- Maximum of 3 PCMs per GC

Capillary Flow Technology

Agilent's proprietary Capillary Flow Technology provides devices with reliable, leak-free, in-oven capillary connections to help analyze complex samples and provide gains in productivity. Devices feature:

- Photolithographic chemical milling for low dead volume flow pathways
- Diffusion bonding to form a single flow plate
- "Credit card" profile for fast thermal response
- Projection welded connections for leak-tight fittings
- Deactivation of all internal surfaces

in the sample path for inertness

All of the following purged Capillary Flow devices require one channel from an auxiliary EPC or PCM module.

Purged capillary flow devices, such as the Deans switch, purged effluent splitters, and QuickSwap, introduce an additional flow in the sample stream. For detectors that operate at low flow rates, like the MSD and TCD, some decrease in sensitivity will occur.

Deans Switch

Deans switching provides additional selectivity using 2-dimensional GC analysis. Peaks of interest that may be coeluting on one column are diverted to a separate column of different stationary phase. This technique can also reduce maintenance costs by having troublesome solvents or other components bypass detectors or columns.

- Dimensions:
65 mm x 31 mm x 1 mm
(65 mm x 31 mm x 11 mm, including weldment connectors with tubing to reach through top of oven.)
- Weight: 30 grams, not including connector tubing.

Purged Effluent Splitters

A 3-way purged effluent splitter sends column effluent to three detectors, even an MSD. More information can be obtained in a single run to help locate target peaks in unknowns. A 2-way purged effluent splitter version is also available.

- Dimensions:
65 mm x 31 mm x 1 mm
(65 mm x 31 mm x 11 mm, including weldment connectors with tubing to reach through top of oven.)
- Weight: 26 grams, not including connector tubing.

QuickSwap

The QuickSwap device, for GC/MS, allows you to change a column or perform inlet maintenance without venting the MSD, saving a considerable amount of downtime.

- Dimensions:
31 mm x 16 mm x 1 mm
(31 mm x 16 mm x 22 mm, including weldment connectors)
- Weight: 10 grams, not including connector tubing.

Backflush

Each of the above purged Capillary Flow devices *also* provides the ability to backflush. By reversing column flow immediately after the last compound of interest has eluted, you can eliminate long bake-out times for highly retained (or high-boiling) contaminants, thereby shortening cycle times and protecting the column and detector. As backflush occurs after peaks of interest have eluted, the chromatographic method for peaks of interest does not need to change. Backflush is available when the column is attached to a split/splitless, volatiles interface, Multimode, or PTV inlet.

The 7890A GC firmware has been optimized for backflush operation:

- Displays positive and negative flows
- Inlet/outlet pressures settable to the limits of the controlling EPC devices.
- EPC can be introduced at any column or restrictor connection
- Capillary Flow configuration of up to six columns/restrictors

Agilent GC Multitechnique

ChemStation, EZChrom Elite data system, and GC/MSD ChemStation now include user-interface screens to simplify backflush set-up and operation with the 7890A GC.

ALS Interface Module

- 7693A ALS Interface standard. Provides power and communications for up to two 7693A automatic injectors, one automatic sampler tray, and one heater/mixer/bar code reader.
- 7683 ALS Interface standard. Provides power and communications for up to two 7683 automatic injectors, one automatic sampler tray, and one bar code reader.
- Injector and tray install easily without the need for alignment.

Data Communications

- LAN
- Two analog output channels (1-mV, 1-V, and 10-V output available) as standard
- Remote start/stop
- Keyboard control of the Agilent Automatic Liquid Sampler (ALS)
- Storage of 10 methods
- Storage of five ALS sequences
- Binary-coded decimal input for a stream selection valve

Maintenance and Support Services

- Remote diagnostics
- Performance verification services

Environmental Conditions/Safety and Regulatory Certifications

The instrument is designed and manufactured under a quality system registered to ISO 9001. The instrument complies with international regulatory, safety, and electromagnetic compatibility requirements. The specifications are more conservative than actual test conditions. In addition, further testing was done under Agilent standards to ensure

operation after delivery and long-term usage. See <http://www.chem.agilent.com/cag/aboutapg/aboutQuality.html> for further information and typical product testing.

- Ambient operating temperature: 15 °C to 35 °C
- Ambient operating humidity: 5% to 95%
- Storage extremes: -40 °C to 70 °C
- Line voltage requirements: ± 10% of nominal
- Conforms to the following safety standards:
 - Canadian Standards Association (CSA): C22.2 No. 1010
 - CSA/Nationally Recognized Test Laboratory (NRTL): UL 3101
 - International Electrotechnical Commission (IEC): 61010-1
 - EuroNorm (EN): 61010-1
- Conforms to the following regulations on Electromagnetic Compatibility (EMC) and Radio Frequency Interference (RFI):
 - CISPR 11/EN 55011: Group 1 Class A
 - IEC/EN 61326
- Designed and manufactured under a quality system registered to ISO 9001, Declaration of Conformity available.

Other Specifications

- Height: 49 cm (19.2 in.)
- Width: 58 cm (22.9 in.) with EPC inlet and detectors; 68 cm (26.8 in.) with third detector as TCD or with certain valving options mounted on left-hand side of GC
- Depth: 51 cm (20.2 in.)
Typical weight: 49 kg (108 lb)
- Four internal 24-volt connections (up to 150 mA)

- Two external 24-volt connections (up to 150 mA)
- Two on/off contact closures (48 V, 250 mA max)
- 550 timed events via data system. 50 timed events via GC keyboard.
- Support for up to 8 valves.
 - Valves 1 to 4, 12V DC 13 watt in a heated valve box
 - Valves 5 to 6, 24 V DC 100 mA unheated, for low power valve applications
 - Valves 7 to 8, externally powered as a remote event from separate contact closure
- Independent heated zones, not including oven: six (two inlets, two detectors, and two auxillary). Third detector as TCD can utilize any available zone from inlet or auxillary zones.
- Maximum operating teperatures for auxiliary zones: 400 °C

References

1. A Guide to Interpreting Detector Specifications for Gas Chromatography. Agilent Technologies, publication 5989-3423EN
2. The Importance of Area and Retention Time Precision in Gas Chromatography. Agilent Technologies, publication 5989-3425EN

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