Data Sheet

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Agilent 8890 Gas Chromatograph

Chromatographic performance*

- Retention time repeatability <0.008 % or <0.0008 minutes
- Area repeatability <0.5 % RSD

The Agilent 8890 GC 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, which lead to extremely precise retention time reproducibility, the basis for all chromatographic measurement.

The 8890 7-inch capacitive touchscreen interface provides real-time access to instrument status, configuration, and flowpath information. A signal plot confirms that analyses are running as intended. Additional tabs provide quick access to key functions such as editing method parameters, diagnostics, maintenance, logs, and help screens.

The Browser Interface is the most extensive interface to the 8890 GC's intelligence and mobile access features. Optimized for a 10-inch tablet, the Browser Interface can be used on tablets or a PC. Now you can view setup information, troubleshoot problems, check for leaks (autonomous hands-free), backflush columns, pause and start sample runs, and manage method development. GC performance can be monitored by automatically evaluating blanks using advanced onboard analytical techniques.

The 8890 has expanded configuration capabilities, where up to two inlets and four detectors can be installed and operated simultaneously. Six GC column smart keys and three USB ports are provided.

Agilent 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 8890 GC has enhanced hardware to extend Capillary Flow capabilities, and enhanced data system software to simplify setup and operation of backflush techniques. Programmable eco-friendly Sleep Mode reduces power and gas consumption during periods of inactivity, while Wake Mode readies the system for high-throughput operation.

* Using 8890 with EPC (splitless), ALS, and Agilent Data System for the analysis of tetradecane (2 ng on column). Results may vary with other samples and conditions.

Agilent GC systems are known for their reliability, ruggedness, and long life. The 8890 EPC is based on Agilent 6th generation microchannel-based EPC architecture. Unique to Agilent, this design protects against gas contaminants such as particulates, water, and oils, and provides significant improvements in reliability and longevity over earlier generation GC designs. 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
  - Four detectors
  - Four detector signals
- State-of-the-art detector electronics and the full-range digital data path enable peaks to be quantified over the entire dynamic 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 eight EPC modules can be installed, providing control of up to 19 channels of EPC.
- Pressure setpoint and contol 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 (three ramps), constant flow, or ramped flow (three 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.
- Serial port interface for Remote Advisor
- Easy access to Maintenance and Service modes from touchscreen and Browser Interface
- Autonomous (hands-free) leak tests
- Automatic Liquid Sampling is fully integrated into mainframe control
- Setpoint and automation control can be done from the local user interface, or Browser Interface, or a networked data system. Clock-time programming can be initiated from the local user interface or Browser Interface to initiate events (on/off, method start, and so forth).
- 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 touchscreen, Browser Interface, or data system
- Context-sensitive online help

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 to 450 °C
  - With LN_2 cryogenic cooling: −80 to 450 °C
  - With CO_2 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)
- Maximum run time: 999.99 minutes (16.7 hours)
- Oven cool down (22 °C ambient) 450 to 50 °C in 4.0 minutes (3.5 minutes with oven insert accessory)
- Ambient rejection: <0.01 °C per 1 °C

Table 1. Typical 8890 GC oven ramp rates.

Temperature range (°C)	120 V Oven* rates (°C/min)	Fast ramp rates** (°C/min)	
		Dual-channel	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.

Electronic Pneumatics Control (EPC)

- Compensation for barometric pressure and ambient temperature changes is standard.
- Pressure has typical control of ±0.001 psi for the range of 0 to 150 psi. Pressure setpoints may be adjusted in increments of 0.001 for the range 0.000 to 99.999 psi, and 0.01 for the range 100.00 to 150.00 psi.
- The user may select pressure units of psi, kPa, or bar
- Pressure/flow ramps: three maximum.
- Carrier and makeup gas settings selectable for He, H_2, N_2, and argon/methane
- Flow or pressure setpoints for each inlet or detector parameter with both the 8890 local user interface, Browser Interface, or Agilent Data System
- Constant flow mode is available when capillary column dimensions are entered into the 8890
- Split/Splitless, Multimode, VI, 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,
    Temperature coefficient <±0.20 mL/min (NTP)* per °C for He or H_2; <±0.05 mL/min NTP per °C for N_2 or Ar/CH_4.

* NTP = 25 °C and 1 atmosphere

- **Detector modules:**
  Accuracy: <±3 mL/min NTP or 7 % of setpoint,
  Repeatability: <±0.35 % of setpoint

Inlets

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

S/SL

- Suitable for all capillary columns (50 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 ≥0.200 mm diameter; 0 to 150 psig for columns <0.200 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 500 mL/min N_2,
  0 to 1,250 mL/min H_2 or He
  0 to 200 mL/min argon/methane
- Turn-top inlet sealing system is built in standard with each 8890 S/SL inlet for quick, easy injector liner changes.
- Optional inert S/SL inlet includes a chemical deactivation process for the weldment and weldment insert.

MMI

- Provides the flexibility of a standard Agilent split/splitless inlet, combined with temperature-programmable capability, enabling large-volume injections. Also supports cool injections for improved signal response.
- Temperature control: LN_2 (to −160 °C), LCO_2 (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 to 530 µm)
- EPC pressure range (psig):
  0 to 100 psig
- Split ratio: 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 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 500 mL/min N_2
  0 to 1,250 ml/min H_2 or He
  0 to 200 mL/min argon/methane
- Turn-top inlet sealing system is built-in standard with each 8890 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 ≥0.250 mm id
- Maximum temperature: 450 °C. Temperature programming in three 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 1/8-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 LN_2 (to −160 °C) or LCO_2 (to −65 °C) cooling. Temperature programming of up to three 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 500 mL/min N_2
  0 to 200 mL/min argon/methane
  0 to 1,250 mL/min H_2 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 (H_2 or He carrier, 0.00 to 100 psig pressure control, 0.0 to 100 mL/min flow control)
- Electronic septum purge flow control
- Treated flowpath provides inert surface for minimum component adsorption
- Maximum temperature: 400 °C

Detectors

- Up to four detectors may be installed and operated simultaneously.
- Electronic pneumatics control and electronic on/off for all detector gases
- EPC compensated for atmospheric pressure and temperature variation

Detectors available

Flame ionization detector (FID)

- Responds to most organic compounds
- Minimum detectable level (for tridecane): <1.2 pg C/s
- Linear dynamic range: >10^7 (±10 %). Full-range digital data path enables peaks to be quantified over the entire 10^7 concentration range in a single run.
- Data rates up to 1,000 Hz accommodate peaks as narrow as 5 msec at half height.

- Standard electronic pneumatic control for three gases:
  - Air: 0 to 800 mL/min
  - H_2 : 0 to 100 mL/min
  - Make-up gas (N_2 or He): 0 to 100 mL/min
- Available in two versions: capillary and column-optimized. 1/8 in. and 1/4 in. adapters will be available
- Flameout detection and automatic reignition
- 450 °C maximum operating temperature

Thermal conductivity detector (TCD)

- 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: $>10^5$ ±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 two gases (He, H_2, or N_2 matched to carrier gas type)
- Make-up gas: 0 to 12 mL/min
- Reference gas: 0 to 100 mL/min
- The 8890 GC can accommodate a third detector.

Electron capture detector

- A very sensitive detector for electrophilic compounds such as halogenated organic compounds.
- Minimum detectable level: <3.8 fg/mL lindane at standard checkout conditions.
- Proprietary signal linearization. Linear dynamic range: $>5 \times 10^4$ 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
- The 8890 GC can accommodate a third detector, as the micro-ECD is located on the left side of the GC.

Nitrogen-phosphorus detector (NPD)

- A detector specific to nitrogen- or phosphorus-containing compounds.
- NPD available: Blos (glass) bead offering:
  - Longer lifetime
  - More stable operation during the bead's lifetime
- MDL: <0.08 pg N/s, <0.01 pg P/s with azobenzene/malathion/ octadecane mixture
- Dynamic range: $>10^5$ N, $>10^5$ P with azobenzene/malathion mixture
- Selectivity: 25,000 to 1 g N/g C, 200,000 to 1 g P/g C with azobenzene/malathion/octadecane mixture
- Data acquisition rate: up to1,000 Hz
- Standard EPC for three gases:
  - Air: 0 to 200 mL/min
  - H_2: 0 to 30 mL/min
  - Make-up gas: 0 to 100 mL/min
- Available for capillary columns only, with adapters available
- 400 °C maximum operating temperature

Flame photometric detector (FPD)+ (Plus)

- Newly designed single-wavelength FPD, or dual-wavelength flame photometric detector (DFPD)—a sensitive, specific detector to sulfur- or phosphorus-containing compounds.
- MDL: <45 fg P/s, <2.5 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
  - H_2: 0 to 250 mL/min
  - Make-up gas: 0 to 130 mL/min
- Available in single- or dual-wavelength versions.
- 400 °C maximum operating temperature
- Can be mounted as AUX1 detector

SCD (Model 8355)

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

NCD (Model 8255)

- 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: $>2 \times 10^7$ 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.

Mass spectrometers

See specifications for:

- 5977 Series MSD
- 7000 triple quadrupole GC/MS
- 7010 Series triple quadrupole GC/MS
- 7250 Q-TOF

Other detectors

Specialized detectors are available through Agilent Channel Partners including: atomic emission, Pulsed Flame Photometric (PFPD), Photoionization (PID), Electrolytic Conductivity (ELCD), Halogen Specific (XSD), Oxygenate Flame Ionization (O-FID), and Pulsed Discharge Helium Ionization (PDHID)

Auxiliary EPC devices

The 8890 GC has four 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. Two of the positions also accommodate detectors.

Note: The communication for a third detector such as a TCD or ECD EPC module (located on the left side of the GC) interfaces through one of these auxiliary EPC module positions. If a third detector (TCD or ECD) is installed, one of these auxiliary positions is taken. Two of these positions are also compatible with a top-mounted or side-mounted detector.

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 three auxiliary EPC modules per GC

Pneumatics Control Module (PCM)

- Two 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 any auxiliary position on the back of the 8890 GC
- Maximum of four PCMs/PSDs per GC

Pneumatics Switching Device (PSD)

- EPC compensated for atmospheric pressure and temperature variation when connected to a user-defined capillary column
- The PSD is a pneumatic module specifically designed for backflush
- First channel: same as PCM; engineered bleed restrictor built in

Capillary Flow Technology

The Agilent 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, PCM, or PSD module.

Purged capillary flow devices, such as the Deans switch, purged effluent splitters, and purged ultimate unions

introduce an additional flow into the sample stream. For detectors that operate at low flow rates, such as the MSD and TCD, some decrease in sensitivity will occur.

Deans switch

Deans switching provides additional selectivity using two-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.

Purged effluent splitters

A three-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 two-way purged effluent splitter version is also available.

Backflush

An Agilent Purged Ultimate Union or any of the above purged Capillary Flow devices also provides the ability to backflush. An auxiliary EPC or PCM can be used for backflushing, but a PSD module is preferred. 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 8890 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

Backflush Wizard software works with Agilent CDS to provide a step-by-step procedure for configuring the backflush hardware and column plumbing. The chromatogram must have three well separated peaks. See Backflush brochure for additional system requirements.

Automated sample injectors and samplers

- The 7693A ALS interface on the 8890 provides power and communications for up to two 7693A automatic injectors, one automatic sampler tray, and one heater/mixer/bar code reader. Injectors and tray install easily without the need for alignment.
- Agilent PAL Injector on 8890. Specialized software controls available on OpenLab CDS ChemStation and EzChrom editions, MassHunter, and MSD Productivity ChemStation.
- The 7650A ALS interface on the 8890 provides power and communications for one 7650 automatic injector. It is also compatible with one additional 7693A mounted on the back inlet. The injector installs easily without the need for alignment.

Data communications

- LAN
- Two analog output channels (1-V and 10-V output available) as standard
- Remote start/stop
- Touchscreen control of the Agilent Automatic Liquid Sampler (ALS)
- Binary-coded decimal input for a stream selection valve
- Serial port interface for Remote Advisor

Maintenance and support services

- Integrated early maintenance counters allows planned maintenance, and helps eliminate unnecessary downtime.
- Instrument events or shutdowns displayed on keyboard display or Data System
- Remote diagnostics
- Performance verification services
- Easy parts identification and part number finder software (standalone software, does not require Agilent CDS)

Environmental conditions

- Ambient operating temperature: 15 to 35 °C
- Ambient operating humidity: 5 to 90 % (noncondensing)
- Storage extremes: –40 to 70 °C
- Power requirements
  - Line voltage: 120/200/220/230/240 Volts ±10 % of nominal
  - Frequency: 50/60 Hz ±5 %

Safety and regulatory certifications

Conforms to the following safety standards:

- Canadian Standards Association (CSA) C22.2 No. 60101-1
- Nationally Recognized Test Laboratory (NRTL): ANSI/UL 61010-1
- International Electrotechnical Commission (IEC): 61010-1, 60101-2-010, 60101-2-081
- 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 61326-1
- AUS/NZ CISPR 11
- This ISM device complies with Canadian ICES-001. Cet appareil ISM est conforme à la norme NMB-001 du Canada.
- Designed and manufactured under a quality system registered to ISO 9001; Declaration of Conformity available.
- This product complies with the EU RoHS Directive 2011/65/EU, and conforms to EN 50581.

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 detector as TCD or with certain valving options mounted on the left side of the 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 through a data system
- Support for up to 10 valves:
  - Valves 1 to 4, 12 V DC, 13 watt in a heated valve box
  - Valves 5 and 6, 24 V DC, 100 mA unheated, for low power valve applications
  - Valves 7 and 8, externally powered as a remote event from separate contact closure
- Independent heated zones, not including oven: Eight (two inlets, three detectors, and three auxillary). Third/fourth detector can use any available zone from inlet or auxillary zones.
- Maximum operating temperatures for auxiliary zones: 400 °C
- Six column ID ports
- Three USB ports

References

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

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Printed in the USA, January 2, 2019
5994-0492EN

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