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## *Agilent 6890N Network Gas Chromatograph*

### **Chromatographic Performance\***

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

The Agilent 6890N 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 temperature control. Each EPC unit is optimized for its intended use with a specific inlet and detector option.

Temperature control of the 6890N 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 control and accurate temperature control leads to outstanding retention time repeatability, the basis for all chromatographic measurement.

A full array of traditional gas sampling and column switching valves are available. A new highperformance inert pneumatic switching manifold is available for a number of advanced chromatographic applications (2-D heart cutting, detector splitting, etc).

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 its life.

### **Agilent 6890N System Capabilities**

- Dual channel design supports two inlets and two detectors.
- Full range digital data output enables the smallest and largest peaks to be quantitated 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.
- 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.
- Automatic Liquid Sampling is fully integrated into mainframe control.
- Set point 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.
- Display of all GC and automatic liquid sampler (ALS) set points at the GC or data system. Agilent supports open connectivity by providing communication protocols to other vendors.

### **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 LN<sub>2</sub> cryo cooling:  
-80 to 450 °C.
  - With CO<sub>2</sub> cryo cooling:

- 40 to 450°C.
- Temperature set point resolution: 1 °C.
- Supports 6 oven ramps with 7 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 min (16.7 h).
- Oven cool down (22 °C ambient) 300 °C to 50 °C in 4.5 min).
- Ambient temperature rejection: <0.01 °C per 1 °C.
- Support for up to 8 valves.
  - Valves 1-4, 12 V DC 13 watt in a heated valve box
  - Valves 5-6, 24 V DC 100 mA unheated, for low power valve applications
  - Valves 7-8, externally powered as a remote event from separate contact closure
- Independent heated zones, not including oven: six (two inlets, two detectors, and two auxiliary).
- Maximum operating temperatures for auxiliary zones: 400 °C.

## Electronic Pneumatics Control (EPC)

- Atmospheric pressure compensation sensor to compensate for altitude and ambient temperature variation is standard.
- Pressure may be adjusted by increments of 0.01 psi.
- Pressure/Flow ramps: Three maximum.
- Carrier and makeup gas settings selectable for He, H<sub>2</sub>, N<sub>2</sub>, and argon/methane.
- Flow or pressure setpoints for each inlet or detector parameter with both Agilent 6890N and Agilent ChemStations.
- Automated carrier has constant flow, when capillary column dimensions are entered into the 6890.
- Split/Splitless, 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 normalized temperature and pressure (NTP)\* per °C for He or H<sub>2</sub>; <±0.05 mL/min NTP per °C for N<sub>2</sub> or Ar/CH<sub>4</sub>.
- Detector modules Accuracy: <±3 mL/min NTP or 7% of setpoint, Repeatability: <±0.35% of setpoint, Temperature coefficient: <±0.20 mL/min NTP per °C.

## Inlets

- Maximum of two inlets installed.
- Inlets available:
  - Packed purged injection port (PPIP)
  - Split/Splitless capillary inlet (S/SL)
  - Temperature-programmable cool on-column (PCOC)
  - Programmable temperature vaporizer (PTV)
  - Volatiles inlet (VI)

## S/SL

- Suitable for all capillary columns.
- Split ratios up to 7500:1 to avoid column overload.
- Splitless mode for trace analysis. Pressure-pulsed splitless is easily accessible for best performance.

- Maximum temperature: 400 °C.
- EPC available in two pressure ranges: 0–100 psig (0 to 680 kPa) for best control for columns 0.200 mm diameter; 0–150 psig for columns <0.200 mm diameter. Pressure set point resolution is 0.01 psig. Total flow control/ sensing up to 1000 mL/min (He, H<sub>2</sub>).
- Gas saver mode to reduce gas consumption without compromising performance.
- Optimized septum purge flow to eliminate “ghost” peaks.
- Total flow setting range:  
0 to 200 mL/min N<sub>2</sub>  
0 to 1,000 mL/min H<sub>2</sub> or He
- Flip top accessory is available for quick, easy, injector liner changes.
- Available with manual pneumatics.

### PCOC

- Direct injection onto cool capillary column assures quantitative sample transfer with no thermal degradation.
- Automatic liquid injection supported directly onto columns  $\pm$ 0.250 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: 0.00 to 100.00 psig.
- Optimized septum purge flow.
- Optional Solvent Vapor Exit for large volume injections.
  - Electronically controlled, inert, three-way valve allows solvent venting.
  - Includes software for method optimization.
  - Pre-assembled retention gaps/vent line/analytical column for easy installation.

### PPIP

- Direct injection onto packed and wide bore capillary columns.
- Electronic flow/pressure control:  
0.0 to 100 psig pressure range,  
0.0 to 100.0 mL/min. Ranges are chosen to provide optimum performance over normal packed column set point ranges.
- 400 °C maximum operating temperature.
- Adapters included for 1/4-inch and 1/8-inch packed columns, and 0.530-mm capillary columns.
- Manual pneumatics available.

### PTV

- Most versatile inlet for difficult samples supporting cool injections and large volume injections in split and splitless modes.
- Temperature control: either LN<sub>2</sub> (to –160 °C) or LCO<sub>2</sub> (to –65 °C) cooling. Temperature programming of up to 3 ramps at up to 720 °C/min. Maximum temperature: 450 °C.
- EPC. Pressure range 0.00 to 100 psig.
- Split ratio up to 1000:1.
- Choice of Gerstel septumless head or Merlin Microseal® septum head.
- 450 °C maximum operating temperature.
- Total flow setting range:
  - 0 to 200 mL/min N<sub>2</sub>
  - 0 to 1,000 mL/min H<sub>2</sub> or He

### VI

- Very low volume (32  $\mu$ L) 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<sub>2</sub> or He carrier, 0.00 to 100 psig pressure control, 0.0 to 100 mL/min flow control).
- Silcosteel® treated flow path provides inert surface for minimum component adsorption.
- Maximum temperature: 400 °C.

## Detectors

All detectors include EPC and electronic on/off for all detector gases. Two channel electronic column bleed compensation is standard. Specialized detectors are available through Agilent Channel Partners including: atomic emission, Helium ionization, sulfur chemiluminescence and pulsed discharge ionization.

### Detectors available:

- Flame ionization detector (FID) which responds to most organic compounds.
- Thermal conductivity detector (TCD), a universal detector that responds to all compounds, excluding the carrier gas.

- Micro-electron capture detector (micro-ECD), a very sensitive detector for electrophilic compounds such as halogenated organic compounds.
- Nitrogen-phosphorus detector (NPD), a detector specific to nitrogen or phosphorous-containing compounds.
- Single- or dual-wavelength flame photometric detectors (FPD), a sensitive, specific detector to sulphur or phosphorous containing compounds.

### FID

- Minimum detectable level (for tridecane): <1.8 pg C/s.
- Linear dynamic range: >10<sup>7</sup> (±10%). Digital data makes entire range available without range changes.
- Data rates up to 200 Hz accommodate peaks as narrow as 25 ms at half height.
- Standard EPC for three gases:
  - Air: 0 to 800 mL/min
  - H<sub>2</sub>: 0 to 100 mL/min
  - Makeup gas (N<sub>2</sub> or He): 0 to 100 mL/min
- Available in two versions: capillary column optimized or adaptable for either packed or capillary columns.
- Flame out detection and automatic reignition.
- Grounded jet.
- 450 °C maximum operating temperature.

### TCD

- Minimum detectable level: 400 pg propane/mL with He carrier. (This value may be affected by laboratory environment.)
- Linear dynamic range: >10<sup>5</sup> ±5%.
- Unique fluidic switching design provides rapid stabilization from turn-on, low-drift performance.
- Signal polarity can be runprogrammed for components having higher thermal conductivity than the carrier gas.
- Maximum temperature: 400 °C.
- Standard EPC for 2 gases (He, H<sub>2</sub>, Ar, or N<sub>2</sub> – matched to carrier gas type).
- Makeup gas: 0 to 12 mL/min.
- Reference gas: 0 to 100 mL/min.

### Micro-ECD

- Minimum detectable level: <6 fg/mL lindane.
- Proprietary signal linearization Linear dynamic range: >5 × 10<sup>4</sup> with lindane.
- Data acquisition rate: up to 50 Hz.
- Uses β emission of <15 mCi <sup>63</sup>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.
- Dynamic range: >5 × 10<sup>5</sup> with lindane.

### NPD

- MDL: <0.4 pg N/s, <0.2 pg P/s with azobenzene/malathion/ octadecane mixture.
- Dynamic range: >10<sup>5</sup> N, >10<sup>5</sup> P with azobenzene/malathion/ octadecane mixture.
- Selectivity: 25,000 to 1 gN/gC, 75,000 to 1 gP/gC with azobenzene/ malathion/octadecane mixture.
- Data acquisition rate: up to 200 Hz.
- Standard EPC for three gases:
  - Air: 0 to 200 mL/min
  - H<sub>2</sub>: 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

- MDL: <60 fg P/s, <3.6 pg S/s with methylparathion.
- Dynamic range: >10<sup>3</sup> S, 10<sup>4</sup> P with methylparathion
- Selectivity: 10<sup>6</sup> gS/gC, 10<sup>6</sup> gP/gC.
- Data acquisition rate: up to 200 Hz.
- Standard EPC for three gases:
  - Air: 0 to 130 mL/min
  - H<sub>2</sub>: 0 to 250 mL/min
  - Makeup gas: 0 to 130 mL/min

- Available in single- or dualwavelength versions.
- 250 °C maximum operating temperature.

### **MSD**

See MSD Specifications, "Agilent 5975 Mass Selective Detector," Publication 5988-3012EN.

### **ALS Interface Module**

- Agilent 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
- RS-232-C (57,600 baud maximum is settable from keyboard)
- Two analog output channels of 1-mV, 1-V, and 10-V, for a total of 6 outputs are standard
- Remote start/stop
- Keyboard control of the Agilent automatic liquid sampler (ALS)
- Storage of nine methods
- Storage of five ALS sequences
- Binary-coded decimal input for a stream selection valve
- Context-sensitive online help



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