

Thermo Scientific TRACE 1600 Series Gas Chromatograph

Stay ahead with measurably more production

Benefits

- Maximize uptime and profitability with a unique modular design that provides off-line maintenance and rapid troubleshooting capabilities
- Enhance efficiency with flexible GC configurations using interchangeable injectors and detectors to address evolving analytical demands
- Streamline operations with proprietary, tool-free Thermo Scientific™ iConnect™ Column Lock for quick, safe, and leak-free capillary column installation
- Conserve helium and reduce operational costs with Thermo Scientific™ HeSaver technology
- Save bench space and optimize workflow with the most compact and highly configurable GC system in the market
- Ensure GLP compliance and avoid unplanned downtime through consumable usage, tracking and replacement alerts
- Facilitate daily operations and routine maintenance with easy-to-follow video guides on the high-resolution touch screen

The Thermo Scientific™ TRACE™ 1600 Series Gas Chromatograph (GC) is the latest technological breakthrough conceived to maximize uptime and profitability. Engineered with the customer in mind, the unique modular design offers a full line of interchangeable injector and detector modules for flexible configurations, elevating efficiency and reducing cost of ownership.

Two models are designed to meet specific laboratory needs. The TRACE 1600 GC offers a single-button local interface, which is ideal when minimum instrumental interaction is preferred. The TRACE 1610 GC enhances the user experience through the advanced multi-functional touch screen, providing direct instrumental control and deep interaction with the system.

Both new and experienced users will value the reliability of the advanced technology, as well as the streamlined adoption facilitated by enhanced usability features.



Thermo Scientific™ TRACE™ 1610 Gas Chromatograph



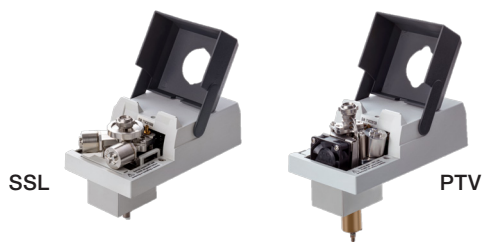
Thermo Scientific™ TRACE™ 1600 Gas Chromatograph

Hardware features

iConnect injectors and detectors

The TRACE 1600 Series GC features user-installable, plug-in Thermo Scientific™ iConnect™ injector and detector modules enabling easy cable- and tubing-free connections. This is achieved with the miniaturized Integrated Electronic Gas Control (IEC) which is comprised of built-in gas manifolds, connections, restrictions and electronic valves in each module, along with electronics for temperature and gas control, signal amplification and A/D conversion.

A wide range of injectors and detectors are available to meet different application needs, and achieve unlimited configurations at any time.



iConnect injector modules:

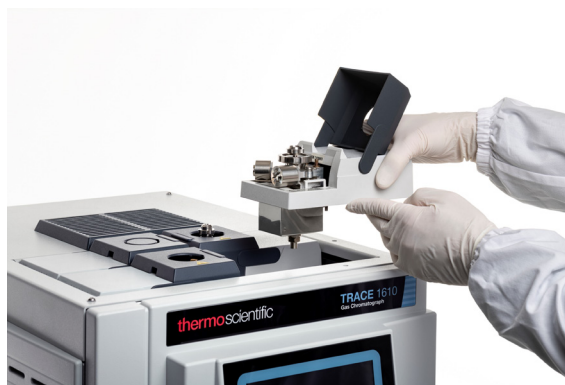
- Split Splitless (SSL)
- Split Splitless with integrated Backflush (SSL-BKF)
- Programmed Temperature Vaporizer (PTV)
- Programmed Temperature Vaporizer with integrated Backflush (PTV-BKF)
- Cold On-Column (COC)
- Thermo Spray Split Splitless Injector (TSI)
- Gas Sampling Valve (GSV)

Integrated backflush

iConnect SSL and PTV injectors are available in the version with integrated backflush capability, avoiding the need for auxiliary gas. The pressure control is self-adjusted for simple operations. Heavy compounds or undesired matrix can be eliminated by reversing the injector flow concurrently during the analysis. This will protect the column and detector while reducing non-productive run times.

Different setups are possible for pre-column, mid-column, and post-column backflushes through the microfluidic 3-port connector based on the SilFlow® technology, allowing for zero-dead volume, finger-tight connections.

Integrated backflush is compatible with capillary columns in the range of 0.32 - 0.1 mm I.D.



iConnect detector modules:

- Flame Ionization Detector (FID)
- Thermal Conductivity Detector (TCD)
- Electron Capture Detector (ECD)
- Flame Photometric Detector (FPD)
- Nitrogen Phosphorous Detector (NPD)
- Pulsed Discharge Detector (PDD)



The TRACE 1600 Series GC can host two iConnect injectors and two iConnect detectors, plus a mass spectrometer. When the GC is configured with the Thermo Scientific TRACE 1600 Auxiliary Oven, it is possible to connect up to four iConnect detectors at the same time, plus a mass spectrometer.

Third-Party detectors compatibility

iConnect Generic Detector Interface module (GDI) allows for digital signal acquisition from third-party detectors using Thermo Scientific™ Chromeleon™ Chromatography Data System (CDS)

TRACE 1600 Series GC is compatible with:

- Xylem OI Pulsed Flame Photoionization Detector (PFPD)
- VUV Analytics Vacuum Ultraviolet (VUV) Absorption Detector
- PAC sulfur/nitrogen Chemiluminescence Detector (SCD/NCD)

iConnect Column Lock

The iConnect Column Lock simplifies capillary column installation on the TRACE 1600 Series GC, eliminating the risk of over tightening and assuring leak-free operations.

- Finger-tight connection in a click
- Facilitates capillary measurement and adjustment before installation
- Compatible with iConnect SSL injector
- Compatible with all iConnect detector modules
- Compatible with the Thermo Scientific™ TriPlus™ 500 Headspace Autosampler interface
- Used in combination with GVF ferrules

HeSaver

The patented Helium Saver technology is integrated into a dedicated iConnect SSL injector module to reduce carrier gas (helium) consumption down to a few mL/min, especially during high-split operations. This significantly extends the helium cylinder operating life by several years, depending on the instrument operative time and method settings, avoiding hassles associated with the helium shortage and delayed delivery. This proprietary patented split/splitless injector module greatly reduces helium carrier gas consumption, using it only to supply the capillary column, while nitrogen is used for all other injection processes: inlet purge and septum, split flow and sample vaporization.

Multi-dimensional GC

Dual-column, dual-detector or heart-cut 2D-GC configurations are achieved with highly inert microfluidic connectors based on the SilFlow technology featuring FingerTite® metal ferrules for easy-to-install, zero-dead volume, and leak-free connections.

- Compatible with capillary columns in the range of 0.32-0.1 mm I.D.
- Software assistant is available to support Heart-cut 2D-GC method setup

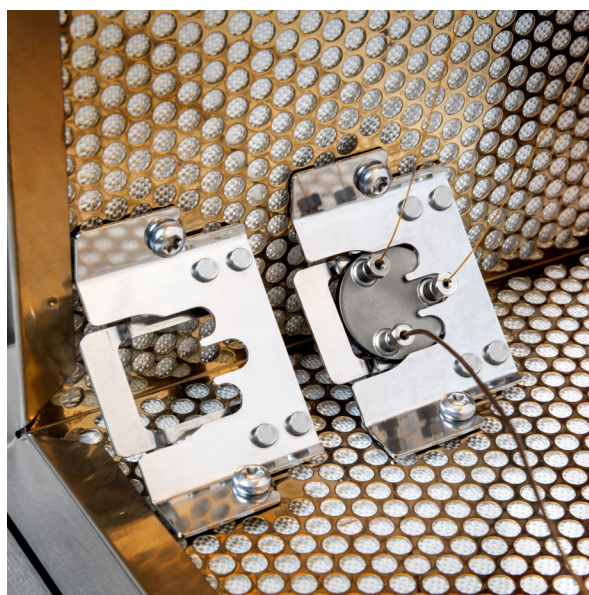
Integrated GC oven light

An LED light is integrated into the GC oven of the TRACE Series GC. The light turns on as the GC oven door opens and illuminates the entire oven. This makes operations like column replacement or column connections more comfortable, despite ambient light conditions.



iConnect NoVent microfluidic module

- Allows column replacement without venting the mass spectrometer
- Works without the need to adjust additional auxiliary gas flow
- Consists of a low-volume, highly inert 3-port microfluidic connector based on the SilFlow technology with FingerTite metal ferrules and a 0.3 m x 75 µm I.D. fused silica MS transfer line
- Compatible with the full range of Thermo Scientific™ Mass Spectrometers (ideal with NOVPI MS configurations)



Local user interface

TRACE 1600 Series GC offers two models designed to meet different instrumental local-interaction requirements.

Minimized local control

TRACE 1600 GC offers a single button for start/stop maintenance and full instrument control from Chromeleon CDS, ideal when minimum instrument interaction is required.

Advanced local touch screen interface

TRACE 1610 GC features a multi-functional icon-based touch screen ideal for local instrument control and method development. It offers advanced functionalities for enhanced operability:

- 7" HD720p capacitive touch screen
- Instrument and consumable health tracking with alert notifications for preventive maintenance
- Built-in video maintenance walk-through guides
- Real-time signal monitoring
- Diagnostic functionalities
- Multi-language capabilities
- USB port for touch screen updates
- TriPlus 500 Headspace Autosampler Control

Hyphenated GC configurations

TRACE 1600 Series GC systems can connect to any Thermo Scientific Mass Spectrometer:

- Thermo Scientific™ ISQ™ Series Single Quadrupole MS
- Thermo Scientific™ TSQ™ Series Triple Quadrupole MS
- Thermo Scientific™ Orbitrap™ MS HRAM

TRACE 1600 Series GC systems can connect to any Thermo Scientific™ ICP-MS instruments through the GCI Series interface



Autosamplers compatibility

TRACE 1600 Series GC systems are compatible with any Thermo Scientific autosamplers for gas chromatography.

TRACE 1600 and 1610 GC systems are compatible with the following third party autosamplers:*

- Markes Thermal Desorption (TD) systems
- Teledyne Tekmar Purge and Trap (P&T) systems
- Gerstel® Multi-Purpose Sampler (MPS)
- Frontier Lab™ Multi-functional Pyrolysis System

**Additional compatibility information is available on request*

Chromatography Data System

TRACE 1600 Series GC systems can be controlled by the following Thermo Scientific CDS:

- Thermo Scientific Chromeleon CDS
- Thermo Scientific™ TraceFinder™ software
- Thermo Scientific™ Xcalibur™ software

Technical Specifications

- Heated zones: up to seven with TRACE 1600/1610 GC, or up to nine with the TRACE 1600 Auxiliary Oven
- Time events: 63 user-selectable events
- Support up to eight valves or 16 valves with the TRACE 1600 Auxiliary Oven
- Typical retention time repeatability*: <0.0008 min
- Typical peak area repeatability*: <0.3% RSD

*Calculated on C16 in n-heptane over 10 splitless injections with AS1610 autosampler, FID detector acquisition and Thermo Scientific CDS data processing

GC oven

- Oven Dimensions (H x W x D): 27 cm x 27 cm x 17.7 cm; Volume: 12.9 L
- Hosts up to two capillary columns 105 m length and 0.53 mm I.D.
- Integrated oven light
- Operating temperature range: ambient +3 °C to 450 °C
- Cryogenic option minimum temperature: -100 °C with liquid N₂; -50 °C with liquid CO₂
- Temperature set point resolution: 0.1 °C
- Number of ramps/plateaus: 32/33
- Maximum heating rate setting: 125 °C/min
- Oven cool down (22 °C ambient): 450 °C to 50 °C in less than 4 minutes
- Ambient rejection: < 0.01 °C per 1 °C

Table 1. Maximum oven heating rate

T Range °C	Heating Rate °C/min	
	Model: 240 Volts	Model: 110 Volts
50 to 70	125	90
70 to 115	100	65
115 to 175	80	50
175 to 300	50	30
300 to 450	35	20

Integrated Electronic Control (IEC)

Gas specification

- Up to 18 channels of integrated electronic gas control
- Pressure set points minimum increments: 0.01 kPa (0.001 psi) for entire range of 0-150 psi
- Temperature pressure variation: max ±0.07 kPa/°C (±0.01 psi/°C)
- Pressure accuracy: <±1% (FS)
- Pressure set point precision: ±0.3 kPa

Carrier gas control common to all injectors

- Split ratio: up to 12500:1
- Pressure range: 0-1050 kPa (0 - 150 psi)

Automatic Temperature and Pressure Compensation

- Temperature compensated sensors are used in the oven and for all pressure sensors to automatically compensate ambient temperature variations
- Temperature sensors read the injector/detector module manifold temperature to correct flow measurements from ambient temperature
- The atmospheric pressure signal is used to correct the pressure setting and reading (gauge pressure) from the inlet modules to maintain constant retention times when atmospheric pressure changes and column outlet is at vacuum (MS detector)

Pneumatic control modes

- Constant and programmed pressures
- Constant and programmed flows
- Constant linear velocity
- Surged pressure split injection
- Surged pressure splitless injection

Total flow setting

- Split flow: OFF or from 0-1250 mL/min in 0.1 mL/min increments
- Reduced split flow after injection with Gas Saver option
- Purge flow: OFF or from 0.5-50 mL/min in 0.1 mL/min increments

Optional Instant Connect Auxiliary Gas module

- Allows for the control of 3 additional gas channels
- Maximum number installed: 2 Aux Gas modules for a total of 6 additional gas channels

Optional Instant Connect Auxiliary Temperature Module

- Controls 2 additional temperature zones (cryo or heated options)
- Maximum number installed: 2 Aux Temp modules for a total of 4 additional temperature zones
- Maximum temperature setting: 400 °C with 1 °C incremental

Injectors

- Maximum number installed: 2 (except for TSI injector which occupies two injector slots)
- Available as Instant Connect, user-exchangeable modules

Instant Connect Split/Splitless Injector (SSL)

- Cold head injector suitable for fast injections (liquid band injections)
- Suitable for all capillary columns of 0.05 mm to 0.53 mm I.D.
- Supports CSR large volume injection (concurrent solvent re-condensation)
- Compatible with 1/8" and 1/16" packed column using adapters
- Supports P&T/TD/HS/Pyrolyzer with dedicated adapters
- Compatible with Merlin Microseal septum
- Maximum temperature: 400 °C
- Dedicated Split/Splitless injector with integrated concurrent backflush capabilities, offering the same specifications, is also available

Instant Connect Programmable Temperature Vaporizer Injector (PTV)

- Suitable for all capillary columns of 0.05 mm to 0.53 mm I.D.
- Supports hot/cold split and splitless modes, as well as large volume injections (solvent split) and On Column (PTV-OC)
- Compatible with Merlin Microseal septum
- Temperature range with ambient air cooling: 5 °C up to 450 °C
- Cryogenic option minimum temperature: -100 °C with liquid nitrogen; -50 °C with CO₂
- Temperature programming of up to 3 ramps at up to 870 °C/min
- PTV cooling rate: from 350 °C to 50 °C in 3.5 min
- Dedicated PTV injector with integrated concurrent backflush capabilities, offering the same specifications, is also available

Instant Connect Thermo Spray Split/Splitless Injector (TSI)

- Hot head injector suitable for hot needle injections (thermo spray injection)
- Suitable for all capillary columns of 0.05 mm to 0.53 mm I.D.
- Maximum temperature: 400 °C

HeSaver Split/Splitless Injector

- Maximum helium consumption: total flow 5 mL/min
- Uses nitrogen for split flow and septum purge
- Suitable for capillary columns with internal diameter between 0.1 mm and 0.32 mm I.D.
- Compatible with P&T/TD/HS sampling techniques
- Can be used in combination with the gas saver mode
- Compatible with Merlin Microseal septum
- Maximum temperature: 400 °C

Instant Connect Cold-On-Column (COC)

- Cold on-column injector for extended boiling point range or thermolabile samples
- Merlin Microseal 26S septum for low maintenance
- Integrated fan for continuous cooling on the injector body

- Secondary cooling
- Suitable for manual and automated injection
- Compatible with syringes with 85 mm, 26 gauge conic needle for 0.53 mm I.D columns

- H₂: 0 - 100 mL/min in 0.1 steps
- Makeup gas: (N₂ or He) 0 - 50 mL/min in 0.1 steps

Instant Connect Gas Sampling Valve

- Maximum temperature: 150 °C
- Valve type: AFP Purged High Performance Mini-Diaphragm Valve, six ports, aluminum body and SS-316L
- Port size: 0.03" (0.76 mm)
- Diaphragm type: AFPD-2
- Actuating pressure: 65 psig (450 kPa) (4.5 bar)
- Tested pressure: 300 psig (2068 kPa) (21 bar)
- Recommended purge flow rate: 5 sccm
- Sampling loops: 20 µL, 50 µL, 100 µL, 250 µL (as standard), 500 µL and 1000 µL
- Suitable for all capillary columns of 0.05 mm to 0.530 mm I.D.
- Compatible with 1/8" and 1/16" packed column using adapters
- Controls switching from load sample to inject sample position (and vice-versa) with user interface

Instant Connect Thermal Conductivity Detector (TCD)

- Capillary column optimized (micro TCD), compatible with 1/8" and 1/16" packed column
- Maximum temperature: 400 °C settable in 0.1 °C steps
- MDL: <400 pg tridecane/mL with helium carrier or <20 pg tridecane/s with a total flow of helium through the cell of 3 mL/min
- Linear dynamic range: 10⁵
- W/Re filament option available for corrosive matrix
- In-series options available

Instant Connect Electron Capture Detector (ECD)

- Radioactive source: 370 MBq equal to 10 mCi, ⁶³Ni
- MDL: <4.5 fg/s lindane
- Linear dynamic range: 10⁴ with lindane
- Maximum temperature: 400 °C settable in 0.1 °C steps
- Integrated gas control (IEC): 0 to 500 mL/min makeup in 0.1 steps
- Make-up gas: nitrogen or 95% argon/5% methane

Instant Connect Nitrogen Phosphorus Detector (NPD)

- NPD available with ceramic beads and compatible with element-specific sources
- Compatible with Blos NPD source
- MDL: <20 fg P/s and <100 fg N/s with standard ceramic bead (TID-2)
- Selectivity: gP/gC = 200,000; gN/gC = 80,000
- Linear dynamic range: 10⁴ for N and P
- Maximum temperature: 450 °C settable in 0.1 °C steps
- Integrated gas control (IEC):
 - Air: 0–500 mL/min in 0.1 mL/min steps
 - H₂: 0–10 mL/min in 0.1 mL/min steps
 - Makeup gas: nitrogen 0–50 mL/min settable in 0.1 steps

Detectors

- Maximum installed: 3 including a mass spectrometer on the same oven, or 4 plus an MS when using the TRACE 1600 Auxiliary Oven
- Fast data acquisition rate: up to 600 Hz for FID and up to 300 Hz for TCD, ECD, NPD, FPD and PDD

Instant Connect Flame Ionization Detector (FID)

- Capillary column optimized, compatible with 1/8" and 1/16" packed column
- Flameout detection and automatic re-ignition
- Minimum Detectable Level (MDL): <1.2 pg C/s
- Sensitivity: 0.03 Coulombs/gC
- Linear dynamic range: >10⁷ (±10%)
- Maximum temperature: 450°C settable in 0.1°C steps
- Integrated gas control (IEC):
 - Air: 0 - 500 mL/min in 0.1 steps

Instant Connect Flame Photometric Detector (FPD)

- MDL: 100 fg P/s and 5 pg S/s (Methyl Parathion)
- Dynamic range: 10^4 (P), $>10^3$ (S)
- Selectivity: P/C = $10^6:1$, and S/C = $10^6:1$
- Maximum temperature: 450 °C base temperature, 200 °C cell temperature settable in 0.1 °C steps
- Also available in dual wavelength version
- Integrated gas control:
 - H₂: 0-100 mL/min in 0.1 steps
 - Air: 0-50 mL/min in 0.1 steps

Instant Connect Pulse Discharge Detector (PDD)

- Operation mode: Universal Helium Ionization Mode
- Maximum temperature: 400 °C
- MDL: <1 pg/s (tetradecane)
- Linear dynamic range: 10^5

Installation Requirements

Power supply

- 230 Vac $\pm 10\%$, 50/60 Hz, 2200 VA
- 120 Vac $\pm 10\%$, 50/60 Hz, 2000 VA

Connectivity

- One Ethernet LAN connection with fixed and dynamic DHCP assignment for PC-based applications
- Two RS-232-C ports for autosampler control; Handshaking h/w signal for external devices

Environment

- Indoor use only
- Operating altitude up to 3500 m above sea level
- Operating temperature: 15 °C to 35 °C (59-95 °F)
- Storage temperature: 5 °C to 40 °C (41-104 °F)
- Maximum RH% 90, non-condensing

Sound pressure level

- <70 dBA (dBA = A weighted sound pressure level)

Certifications

Conforms to the following safety standards according to Machinery Directive 2006/42/EC and Low Voltage Directive 2006/95/EC:

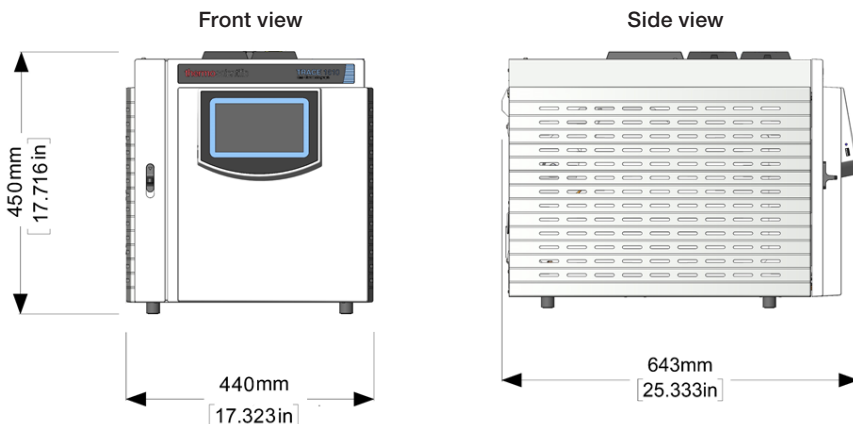
- International Electrotechnical Commission (IEC): 61010-1:2001 - 61010-2-010:2003 - 61010-2-081:2001 + A1:(2003)
- National differences: CAN/CSA C22.2 No. 61010-1 and UL 61010-1
- EuroNorm (EN): 61010-1:2001 - 61010-2-010:2004 - 61010-2-081:2002

Conforms to the following regulations on Electromagnetic Compatibility (EMC) and Radio Frequency Interference (RFI) according to directive 2004/108/EC:

- CISPR 11/EN 55011: Group 1 Class A
- IEC/EN 61326-1:2012

Dimension and Weight

- Dimensions (H x W x D): 45 x 44 x 67 cm (17.7 x 17.3 x 26.4 in)
- Weight: 35 kg (77.2 lb) main unit plus 0.8 kg (1.7 lb) each Instant Connect injector or detector module



TRACE 1600 Auxiliary Oven

To expand the TRACE 1600 Series GC for multi-valve and multi-column configurations, TRACE 1600 Auxiliary Oven is mounted on the right-side, allowing a mass spectrometer to be connected to the left-side of the GC.

Primary Oven Chamber

- User interface: one power LED
- Minimum temperature: 30 °C with ambient temperature of 22 °C
- Maximum temperature: 300 °C, isothermal
- Up to 8 diaphragm valves or up to 6 rotary valves can be installed
- Internal oven dimensions (H x W x D): 32.8 x 20.0 x 20.5 cm (12.9 x 7.9 x 8.1 in)

Secondary column oven (optional and alternative to methanizer) keeps columns at lower temperature when using high temperature valves

- Minimum temperature: 30 °C, with Auxiliary Oven temperature of 30 °C and ambient temperature of 22 °C
- Maximum temperature: 250 °C, isothermal
- Internal dimensions (H x W x D): 80 x 80 x 20 mm

Methanizer (optional and alternative to secondary oven)

- Maximum temperature: 400 °C
- Nickel catalyst reactor

Two additional Instant Connect detectors

can be installed, with 10 Hz acquisition speed

External connections for sampling (front)

- Possibility to connect up to 8 needle valves or other heated accessories, directly inside the primary oven
- Additional 6 holes for un-heated connections

External connections for sampling (back)

- Possibility to connect up to 6 needle valves or other heated accessories, directly inside the primary oven
- Possibility to connect one heated transfer line, 50 mm external diameter, inside the primary oven

Dimension and Weight

- External dimensions (H x W x D): 45 x 31 x 67 cm (17.7 x 12.2 x 26.4 in.)
- Weight: 27 kg (59.5 lb) (without columns, valves or optional modules)

Power supply

- Power: 110/240V (autorange)

Compact Auxiliary Oven

A smaller and compact valve box can be mounted on the right-hand side of the TRACE 1600 Series GC, in place of the TRACE 1600 Auxiliary Oven:

- Hosts up to two rotary valves with pneumatic actuator
- Optional valves heater with a max temperature of 180 °C

Dimension and Weight

- TRACE 1600 Series GC with Compact Aux Oven (H x W x D): 45 x 52 x 67 cm (17.7 x 20.5 x 26.4 in.)
- TRACE 1600 Series GC with Compact Aux Oven weight: 50 kg (110 lb)



TRACE 1610 Gas Chromatograph with the TRACE 1600 Auxiliary Oven

Find out more at thermofisher.com/tracegc

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