

Thermo Scientific  
**TRACE GC Ultra**  
Gas Chromatograph

**Getting Started**

PN 31709230, Revision May 2007

HOME



## **TRACE™ GC Ultra Getting Started**

May 2007 Edition

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- installation
- re-calibration
- changes and repairs

have been carried out by authorized personnel and if:

- the local installation complies with local law regulations
- the instrument is used according to the instructions provided, and if its operation is only entrusted to qualified, trained personnel

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**Thermo Electron S.p.A.**

Strada Rivoltana  
20090 Rodano (MI)  
ITALY

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## Contents

# About This Manual

## Overview

---

The TRACE GC Ultra *Getting Started* manual offers step-by-step instructions for making your first analysis with the TRACE GC Ultra a success. If you follow the procedures provided, by the end of the guide you will have:

- checked the TRACE GC Ultra's software configuration to make sure it matches the hardware configuration and your purchase order
- installed the detectors, if necessary
- analyzed a standard test mixture
- gained an understanding of the possibilities for automating analyses

This guide is written for users with some experience in gas chromatography. Less experienced users are encouraged to explore additional sources of information. If you would like more instruction, ask your customer service representative about Thermo Fisher Scientific training courses in basic gas chromatography.



**WARNING!** Before using this guide, you must have already prepared your workspace and installed the TRACE GC Ultra in accordance with the TRACE GC Ultra *Site Preparation and Installation Manual*.

This manual is organized as follows:

Chapter 1, *Configuring the Instrument*, explains how to check and modify the TRACE GC Ultra's configuration by examining and editing the software menus.

Chapter 2, *Working with Detectors*, explains how to install a detector on the TRACE GC Ultra. It also contains detector parameters and operating tips.

Chapter 3, *Operating the TRACE GC Ultra*, contains instructions to run an analysis.

Chapter 4, *Automating Your Analyses*, discusses the basics of automation in analytical methods and autosampler sequences.

Appendix A, *Customer Communication*, contains contact information for Thermo Fisher Scientific offices worldwide. Use the *Reader Survey* in this section to give us feedback on this manual and help us improve the quality of our documents.

The *Glossary* contains definitions of terms used in this guide and the help diskette. This also includes abbreviations, acronyms, metric prefixes, and symbols.

The *Index* contains an alphabetical list of key terms and topics in this guide, including cross-references and the corresponding page numbers.

## Conventions Used in This Manual

---

The following symbols and typographical conventions are used throughout this manual.

**Bold** Bold text indicates names of windows, menus, dialog boxes, buttons, and fields.

*Italic* Italic indicates cross references, first references to important terms defined in the glossary, and special emphasis.

Monospace Monospace, or Courier, indicates filenames and filepaths, or text the user should enter with the keyboard.

**Monospace Bold** Monospace Bold indicates messages or prompts displayed on the computer screen or on a digital display.

» This symbol illustrates menu paths to select, such as **File»Open....**

**KEY NAME** Bold, uppercase sans serif font indicates the name of a key on a keyboard or keypad, such as <**ENTER**>.



This symbol alerts you to an action or procedure that, if performed improperly, could damage the instrument.



This symbol alerts you to important information related to the text in the previous paragraph.



This symbol alerts you to an action or procedure that, if performed improperly, could result in damage to the instrument or possible physical harm to the user. This symbol may be followed by icons indicating special precautions that should be taken to avoid injury.



This symbol indicates electric shock hazard.



This symbol indicates danger from hazardous chemicals.



This symbol indicates danger from high temperature surfaces or substances.



This symbol indicates a fire hazard.



This symbol indicates an explosion hazard.



This symbol indicates a toxic hazard.



This symbol indicates the presence of flammable materials.



This symbol indicates the presence of radioactive material.



This symbol indicates an operation or procedure that must NOT be performed by the user. A Thermo Fisher Scientific authorized Customer Support Engineer must perform this procedure.



This symbol indicates all metal objects, such as watches and jewelry, must be taken off.



This symbol indicates an eye hazard. Eye protection must be worn.



This symbol indicates the user must wear a protective screen when performing the procedure.



This symbol indicates the user must wear protective shoes when performing the procedure.













This symbol indicates the user must wear protective clothing when performing the procedure.











This symbol indicates the user must wear gloves when performing the procedure.

# Instrument Markings and Symbols

The following table explains the symbols used on Thermo Fisher Scientific instruments. Only a few of them are used on the TRACE GC Ultra gas chromatograph.

| Symbol                                                                              | Description                         |
|-------------------------------------------------------------------------------------|-------------------------------------|
|    | Direct Current                      |
|    | Alternating Current                 |
|    | Both direct and alternating current |
|    | Three-phase alternating current     |
|    | Earth (ground) terminal             |
|  | Protective conductor terminal       |
|  | Frame or chassis terminal           |
|  | Equipotentiality                    |
|  | On (Supply)                         |
|  | Off (Supply)                        |

| Symbol                                                                              | Description                                                                                                                                                                                   |
|-------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|    | Equipment protected throughout by DOUBLE INSULATION or REINFORCED INSULATION (Equivalent to Class II of IEC 536)                                                                              |
|    | Instruction manual symbol affixed to product. Indicates that the user must refer to the manual for specific Warning or Caution information to avoid personal injury or damage to the product. |
|    | Caution, risk of electric shock                                                                                                                                                               |
|    | Caution, hot surface                                                                                                                                                                          |
|    | Caution (refer to accompanying documents)                                                                                                                                                     |
|    | In-position of a bistable push control                                                                                                                                                        |
|   | Out-position of a bistable push control                                                                                                                                                       |
|  | Symbol in compliance to the Directive 2002/96/EC on Waste Electrical and Electronic Equipments (WEEE) placed on the european market after August, 13, 2005.                                   |

# Using the TRACE GC Ultra Document Set

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The TRACE GC Ultra Document Set (CD-Rom PN 317 095 00) includes all manuals in electronic format, and serves as your library for information about the TRACE hardware and software.

The TRACE GC Ultra Document Set (PN 317 093 00) as paper copy is also available. Furthermore, Thermo Fisher Scientific part numbers (PN) for the paper copy manuals are provided for each book title.

## *Acceptance Package* (PN 317 092 20)

This folder contains required shipping documents and quality report forms.

## *Site Preparation and Installation Manual* (PN 317 091 90)

This manual and diskette describes how to set up a workspace for the TRACE GC and how to connect the instrument to the gas supplies and peripheral devices. It also contains a list of spare parts.

## *Getting Started* (PN 317 092 30)

This guide contains procedures for checking configuration, installing detectors, and making a first analysis with the TRACE GC Ultra.

## *Operating Manual* (PN 317 091 70)

This manual provides descriptions of the TRACE GC Ultra hardware and software and instructions for their use. It also contains the instrument warranty.

## *UFM Ultra Fast Module Device* (PN 317 093 98)

This manual provides descriptions of the TRACE GC Ultra equipped with the UFM device, and instructions for its use.

## *Quick Reference Card* (PN 317 092 40)

This reference card contains guidelines for carrier gas use and injection procedures.

## *K-Factor Quick Reference* (P/N 317 092 41)

This reference card contains information to interpretate results from a Column Evaluation.

*Preventive Maintenance Schedule* (PN 317 092 80)

This document provides a recommended maintenance schedule and a year-long log book to record maintenance, observations, supply lists, and service records.

*Maintenance and Troubleshooting Guide* (PN 317 091 80)

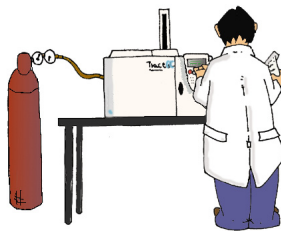
This manual contains instructions for diagnosing and resolving operational problems.

*Standard Operating Procedures* (PN 317 092 00)

This manual contains a series of instructions, operations and test criteria for final testing of the TRACE GC Ultra.

*Spare Parts Catalog* (P/N 317 092 10)

This manual contains the spare parts catalog of the TRACE GC Ultra System.



# Configuring the Instrument

This chapter explains how to check and modify the TRACE GC Ultra's configuration by examining and editing the software menus. To configure an instrument, you match the software specifications with the hardware. If a Thermo Fisher Scientific customer service engineer has already performed this task, you do not need to repeat it unless you wish to change the configuration. For instance, if you want to exchange detectors, you will need to edit the **RIGHT** or **LEFT DETECTOR** menus and possibly others.

The TRACE GC Ultra has been configured to your specifications at the factory. Now you will check your purchase order against the instrument settings.

## ***Chapter at a Glance...***

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## Getting Ready

---

If a Thermo Fisher Scientific customer service engineer installed your instrument, your detectors probably have been installed. If not, you will check the configuration and install the detectors accordingly. For instance, if the **LEFT DETECTOR** menu specifies an FID (flame ionization detector), you will install an FID at the left detector position.



### CAUTION

**Before turning on the TRACE GC Ultra, check to see which detectors were ordered with your instrument. If an ECD (electron capture detector) will be used, do not turn on the power until it has been installed. If these detectors are configured but not installed, the TRACE GC Ultra could shut down. For installation instructions, see [Working with Detectors](#) on page 21.**

After the ECD detectors are installed, turn on the power switch.

Figure 1-1 below shows the TRACE GC Ultra keypad. To check the configuration, you will use the keypad to call up the appropriate menus.

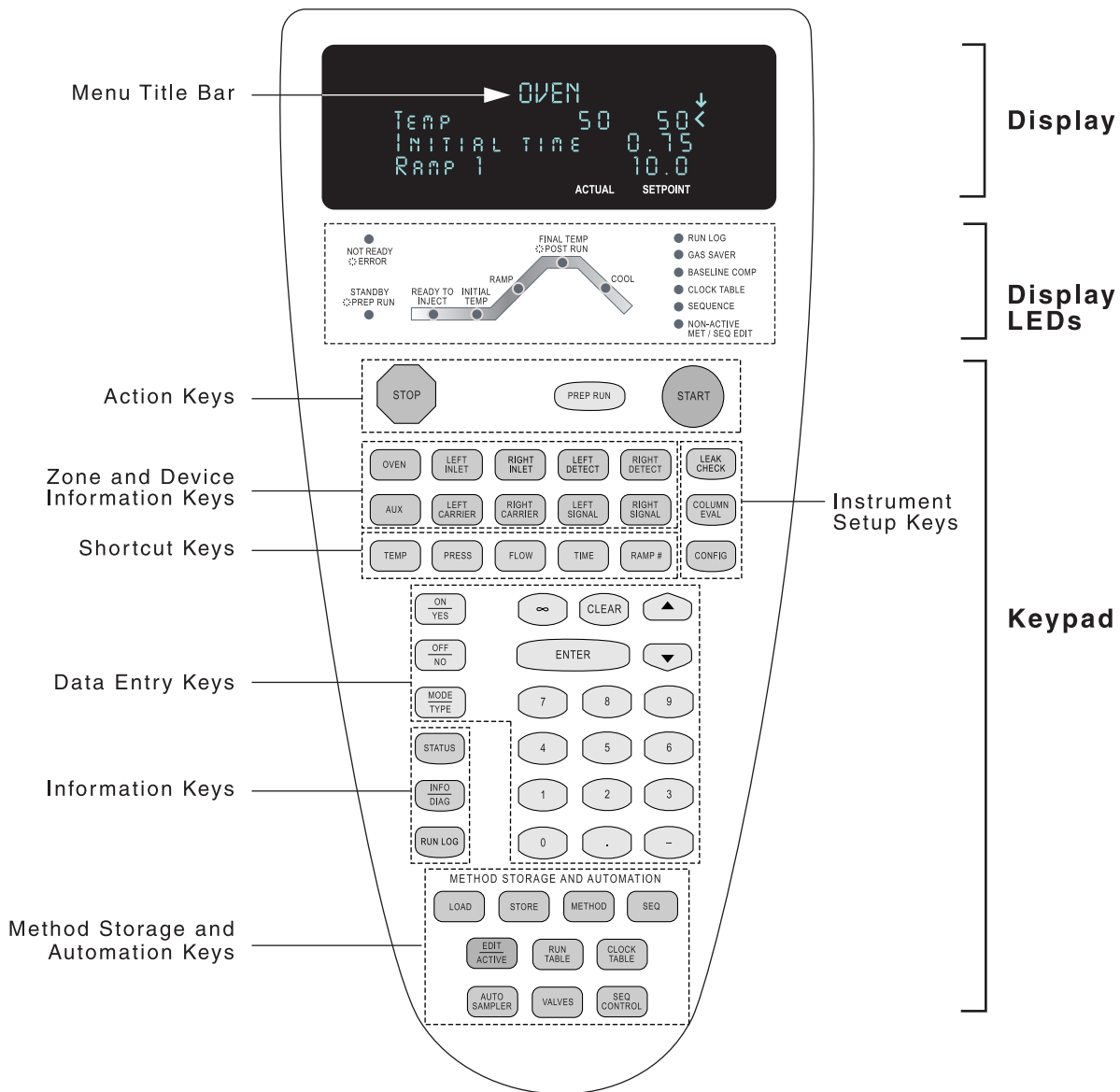


Figure 1-1. TRACE GC Ultra Keypad

To see the configuration settings for your instrument, press **CONFIG**. The **CONFIGURATION** main menu appears. Each item in the **CONFIGURATION** main menu leads to a submenu.

## Navigating TRACE GC Ultra Menus

---

The display screen on the keypad shows the TRACE GC Ultra menus, and can show up to three lines at a time. If the menu has more than three lines, a scroll indicator (↓, ↑, or ↕) in the upper right corner of the display indicates which direction you can scroll to see additional lines. A title bar in capital letters always appears on the top line to let you know which menu you are viewing.

### Viewing a Submenu

When you press **CONFIG**, the **CONFIGURATION** main menu appears. Use the following procedure to examine the configuration submenus.


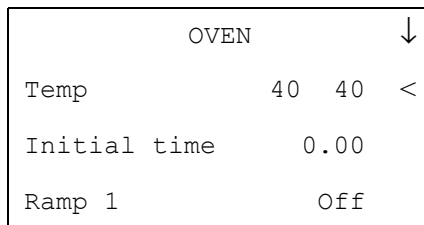
1. Press  to move through the menu. The cursor (<) moves as you scroll.
2. To see a submenu, press **ENTER** or **MODE/TYPE**. If the configured options are incorrect, use the procedure in [Editing a Menu Item](#) on page 20 to correct them.
3. To return to the main menu or the next higher level menu, press **CLEAR**.

Figure 1-2 below shows how the **OVEN** submenu display might look.



|              |       |   |
|--------------|-------|---|
|              | OVEN  | ↓ |
| Temp         | 40 40 | < |
| Initial time | 0.00  |   |
| Ramp 1       | Off   |   |

**Figure 1-2.** Oven Menu Display


Table 1-1 shows the **CONFIGURATION** main menu and explains what to check for.

**Table 1-1.** Main Configuration Menu

| Menu               | Comments and Checkpoints                                                                                                                                                                                      |
|--------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| CONFIG↓            | The scroll indicator (↓) denotes that the menu contains more items than what is currently shown on the display.                                                                                               |
| Oven<              | q If you ordered <b>oven cryogenic options</b> , they should appear in this menu.                                                                                                                             |
| Active inlet       | q This menu item should appear if you ordered a <b>column select valve</b> .                                                                                                                                  |
| Left inlet         | Controls mode for left on-column. No options appear if you are using a split/splitless or packed column inlet.<br>q Check to see that the <b>inlet</b> and <b>mode</b> you specified is configured.           |
| Left carrier       | q Check that the correct carrier gas for the left inlet has been chosen.<br>q If you ordered a <b>hydrogen sensor</b> , <b>H2</b> should appear on this menu.                                                 |
| Right inlet        | Controls mode for the right on-column. No options will appear if you are using a split/splitless or packed column inlet.<br>q Check to see that the <b>inlet</b> and <b>mode</b> you specified is configured. |
| Right carrier      | q Check that the correct carrier gas for the right inlet has been chosen.<br>q If you ordered a <b>hydrogen sensor</b> , <b>H2</b> should appear on this menu.                                                |
| Left detector      | q Check that the <b>detector type</b> matches your order.                                                                                                                                                     |
| Right detector     | q Check that the <b>detector type</b> matches your order.                                                                                                                                                     |
| Aux detector       | q If you ordered an <b>auxiliary detector</b> , this item should appear.                                                                                                                                      |
| Aux Zones          | q If you ordered <b>auxiliary devices</b> such as a jet separator, they should appear in this menu.                                                                                                           |
| Time               | Sets time and date.                                                                                                                                                                                           |
| Valves             | q If you ordered any extra <b>valves</b> , they should appear on this menu. (A valve oven's three valves would be listed here.)                                                                               |
| Autosampler        | q If an <b>autosampler</b> is not connected, the submenu will not appear when you select it.                                                                                                                  |
| Handshaking        | Configures signal polarity to and from external devices.                                                                                                                                                      |
| Keyboard & display | Controls keyboard and display preferences.                                                                                                                                                                    |

## Editing a Menu Item

If you need to make changes to a submenu, use the following procedure.

1. To select a menu item, use the  key to scroll through the menu until the cursor (<) points to the item you want to edit.
2. To display the selected field's range and options, press the **INFO/DIAG** key once. If the field cannot be edited, no information will appear. Press **CLEAR** to return to the menu.
3. You can change the field's content in several ways:
  - To choose on/off or yes/no, use the **ON/YES** and **OFF/NO** keys.
  - To enter a number, use the numeric keypad.
  - If the field cannot be filled with on/off, yes/no, or a number, press **ENTER** or **MODE/TYPE** to display a submenu of choices. In the submenu, you might use the keypad, or you might select an item by scrolling with the arrow keys. While you are editing a numeric field, a blinking asterisk (\*) appears to the right of the menu item.




### NOTE

You cannot edit items in parentheses.

4. When you have entered the proper information in the field, press **ENTER** to load the new setpoint. The blinking asterisk disappears and the cursor advances to the next menu item.

To erase an entry before choosing it, press **CLEAR**.

5. Use the  key to scroll to the next item you want to edit.



### ***Do you want to know more?***

For more information on configuring the TRACE GC Ultra, see Chapter 3, *Configuration*, in the TRACE GC Ultra *Operating Manual*.



# 2

## Working with Detectors

This chapter explains how to install a detector on the TRACE GC Ultra. It also contains detector parameters and operating tips.

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The FID (Flame Ionization Detector), NPD (Nitrogen Phosphorus Detector), FPD (Flame Photometric Detector), PID (Photoionization Detector), TCD (Thermal Conductivity Detector) and PDD (Pulsed Discharge Detector) are already installed on the TRACE GC Ultra according to your requirements. Due to Local Regulations of radioactive materials, the ECD (Electron Capture Detector) is sent separately from the GC unit.

If you need to install other detectors, do so in accordance with the configuration settings. For example, if the left detector is specified as an ECD, install the ECD on the left side.

## Installing Detectors

---

The detector base body allows you to easily install or exchange detectors. Use the following procedure to install a detector.

1. Remove the TRACE GC Ultra cover plate from the top of the instrument.
2. Install the appropriate detector.
3. Tighten the detector nut.
4. Attach the appropriately labeled cables to the detector body.

Figure 2-1 shows how an ECD would fit into the detector base body.

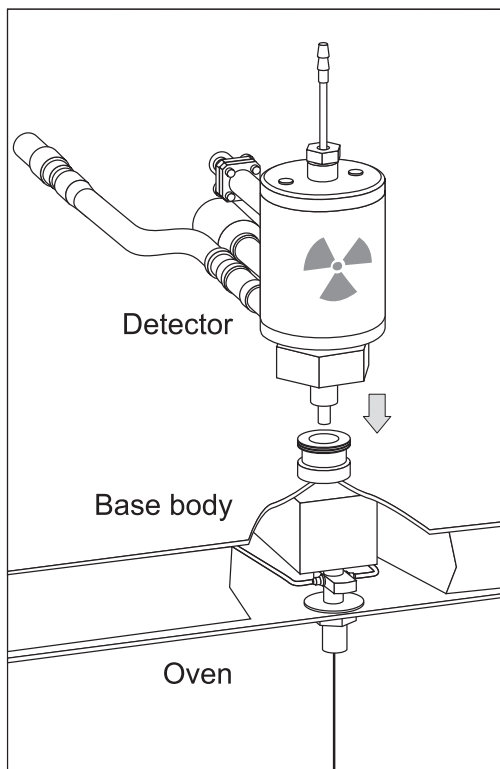


Figure 2-1. Detector Installation Diagram



***Do you want to know more?***

For more information on installing and maintaining detectors, see the *TRACE GC Maintenance and Troubleshooting Manual*.

# Getting the Most from the Detector

Table 2-1 describes the TRACE GC Ultra detector options, parameters, possible applications, and operating suggestions.

**Table 2-1.** Detector Options, Sensitivities, and Tips

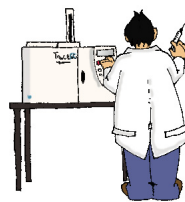
| Detector | Minimum Detectable Amount    | Linear Range | Typical Applications                                                                                                                                                    | Operating Tips                                                                                                                                                                                                                              |
|----------|------------------------------|--------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| FID      | 2 pg C/s                     | $10^6$       | <ul style="list-style-type: none"> <li>hydrocarbons</li> <li>almost all organic compounds, such as alcohols, essential oils, and fatty acids</li> </ul>                 | Make sure the flame is adjusted correctly. For maximum sensitivity with capillary columns, use makeup gas (nitrogen).                                                                                                                       |
| NPD      | N 0.05 pg/s<br>P 0.02 pg/s   | $10^4$       | <ul style="list-style-type: none"> <li>triazine herbicides</li> <li>organophosphorus pesticides (EPA 507)</li> <li>nicotine, caffeine nitrosamines (EPA 607)</li> </ul> | <p>Both sensitivity and specificity are affected by the amount of hydrogen flow and the amount of heat supplied to the thermionic source.</p> <p>Avoid column liquid phases with N or P, halogenated solvents, and silylation reagents.</p> |
| ECD      | 0.01pg/s (lindane)           | $10^4$       | <ul style="list-style-type: none"> <li>organochlorinated pesticides</li> <li>halogenated contaminants in water and soil</li> <li>PCBs in oil</li> </ul>                 | Use a filter to trap oxygen and water.                                                                                                                                                                                                      |
| FPD      | P = 0.1 pgP/s<br>S = 5 pgS/s | $10^4$ (P)   | <ul style="list-style-type: none"> <li>organophosphorus pesticide</li> <li>phosphine</li> <li>sulphur gases</li> </ul>                                                  | <p>The detector is equipped with sulphur interference (394 nm).</p> <p>Use 526 nm interference filter for phosphorus determinations.</p>                                                                                                    |

**Table 2-1.** Detector Options, Sensitivities, and Tips (Continued)

| Detector | Minimum Detectable Amount                 | Linear Range    | Typical Applications                                                                                                                                                                                          | Operating Tips                                                                                                      |
|----------|-------------------------------------------|-----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------|
| PID      | Benzene 1 pg/s<br>(using 10.6 eV UV lamp) | 10 <sup>5</sup> | <ul style="list-style-type: none"> <li>• low boiling aromatics (BTEX)</li> <li>• polycyclic aromatic hydrocarbons</li> <li>• amines</li> </ul>                                                                | Select proper UV lamp according to the application.                                                                 |
| TCD      | 600 pg ethane/ml<br>He carrier            | 10 <sup>6</sup> | <ul style="list-style-type: none"> <li>• permanents gases</li> <li>• organic and inorganic compounds not detectable by FID such as carbon disulphide, ammonia, water</li> </ul>                               | Select Constant Voltage operation mode for maximum linearity.                                                       |
| PDD      | 0.2 pg/s methane                          | 10 <sup>5</sup> | <ul style="list-style-type: none"> <li>• permanents gases</li> <li>• light hydrocarbons</li> <li>• organic and inorganic compounds not detectable by FID such as carbon disulphide, ammonia, water</li> </ul> | Use only Helium of high purity (99.999%) along with an helium purifier on both the carrier and discharge gas lines. |



**WARNING!** Because of its radioactive source, an ECD has special handling and reporting requirements.



# 3

## Operating the TRACE GC Ultra

This chapter contains instructions to run an analysis. With all components installed and configured, you are ready to make the first run, probably a simple manual injection of a test mixture. You will need to have your data system or integrator connected and turned on to see the chromatogram. Save the first chromatogram to compare future performance and to help resolve service issues.

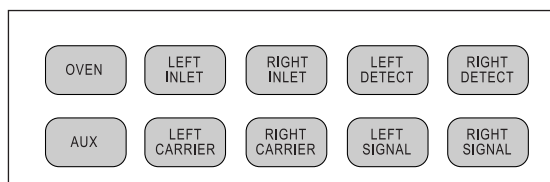
### ***Chapter at a Glance...***

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## Setting Up an Analysis

---

1. Choose the text mixture or standard you will inject. Your choice will depend on your intended applications and standard laboratory practice.
2. A default analytical method has been installed in the TRACE GC Ultra. To see its parameters, press each of the keys shown in Figure 3-1 and examine the settings for each menu item.



**Figure 3-1.** Zone and Device Keys to Set Run Parameters

3. If you want to make changes to any menu, follow the procedures outlined in [Editing a Menu Item](#) on page 20.

## Example

Menu settings to run the Thermo Fisher Scientific Calibration Mixture for an FID (PN 338 190 20) with a splitless injection might look like those in the following figure:

| OVEN         |      |    |
|--------------|------|----|
| Temp         | 50   | 50 |
| Initial time | 1.00 |    |
| Ramp 1       | 20.0 |    |
| Final temp 1 | 200  |    |
| Final time 1 | 1.0  |    |
| Ramp 2       | Off  |    |
| Postrun temp | Off  |    |

| LEFT INLET <sup>1</sup> |           |     |
|-------------------------|-----------|-----|
| Temp                    | 230       | 230 |
| Pressure                | 30        | 30  |
| Mode                    | splitless |     |
| Total flow              | (60.0)    |     |
| Split flow              | 57        | 57  |
| Splitless time          | 0.8       |     |
| Const sept purge?       | Y         |     |

| LEFT DETECTOR <sup>1</sup> |       |     |
|----------------------------|-------|-----|
| Flame                      | On    |     |
| Base temp                  | 250   | 250 |
| Signal pA                  | (3.1) |     |
| Ignition thresh            | 2.0   |     |
| Flameout retry             | Off   |     |
| H2                         | 35    | 35  |
| Air                        | 350   | 350 |
| Mkup (N <sub>2</sub> )     | 30    | 30  |

| LEFT CARRIER <sup>1</sup> |          |    |
|---------------------------|----------|----|
| Col. flow                 | 3.0      |    |
| Pressure                  | 30       | 30 |
| Flow mode                 | con pres |    |
| Gas saver flow            | Off      |    |
| Vacuum comp               | Off      |    |

| LEFT SIGNAL (FID) <sup>1</sup> |        |  |
|--------------------------------|--------|--|
| Output                         | (1000) |  |
| Offset                         | Off    |  |
| Auto zero?                     | N      |  |
| Range=10^(0.3)                 | 0      |  |
| Analog filter                  | Off    |  |
| Baseline comp                  | Off    |  |

1. These settings could also be for a right inlet/detector/carrier/signal.

**Figure 3-2.** Menu Settings for Thermo Fisher Scientific Calibration Mixture for an FID

## Injecting a Test Mixture

---

Although in the future you will probably automate most analyses, you should do the first run with a manual syringe injection.

To analyze the Calibration Mixture for an FID, you will need a 10- $\mu$ L syringe with a 51 mm needle. The column and liner shipped with your TRACE GC Ultra are appropriate for this analysis.



### ***Do you want to know more?***

For more information on performing injections, see Section III, *Injectors*, in the TRACE GC Ultra *Operating Manual*.

Table 3-1 lists three columns: TRACE GC Ultra Status, Manual Control, and Automated Control. The first column describes how the TRACE GC Ultra Status LEDs look during each stage in a run. The second column, Manual Control, describes the steps and decisions you would face in manually operating the TRACE GC Ultra. The third column describes automated control options you might consider.

Once you have prepared a syringe for injection, follow the instructions listed under Manual Control in Table 3-1. In the case of the calibration mixture for an FID, you would draw a 1- $\mu$ L sample and inject this amount, including the mixture remaining in the needle.

Table 3-1. Steps in a TRACE GC Ultra Run

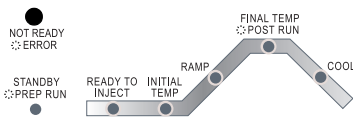

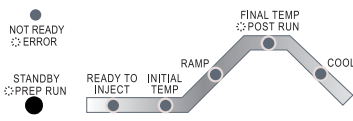

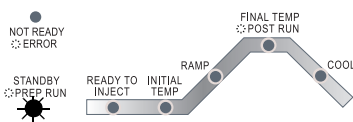


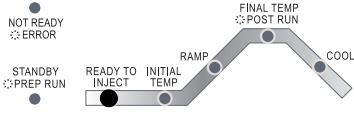
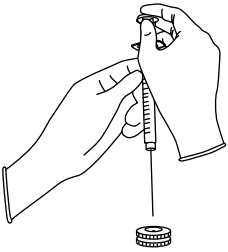


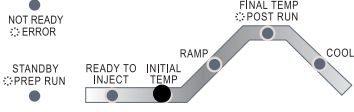

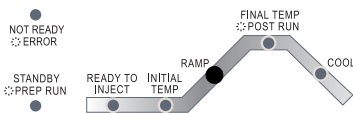


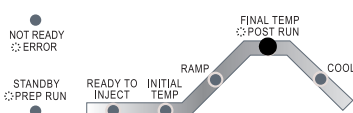

| TRACE GC Ultra Status                                                                                                                                                                                                                                        | Manual Control                                                                                                                                                                                                                                   | Automated Control                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p><b>NOT READY</b></p>  <p>At this point the TRACE GC Ultra is heating the oven to the temperature specified in the <b>OVEN</b> menu.</p>                                  | <p>No action is necessary. However, you could set parameters for the run, if you haven't done so already.</p> <p>More information is available about the oven, inlets, carrier, and detectors in the TRACE GC Ultra <i>Operating Manual</i>.</p> | <p>No action is necessary. However, you could load a preprogrammed method and/or sequence. Press <b>LOAD</b> and make the appropriate menu selections.</p> <p style="text-align: center;"></p>                                                                                                                                                                                           |
| <p><b>STANDBY</b></p>  <p>The oven has reached the initial temperature.</p>                                                                                                 | <p>Press <b>PREP RUN</b>.</p> <p style="text-align: center;"></p>                                                                                               | <p>If you are using an autosampler, the autosampler sequence will automatically start the prep run before an injection.</p> <p>More information is available about the oven and equilibration times in the TRACE GC Ultra <i>Operating Manual</i>.</p>                                                                                                                                                                                                                      |
| <p><b>PREP RUN</b></p>  <p>The TRACE GC Ultra sets all conditions ready for a run. The Standby/Prep Run LED blinks during this phase.</p>                                 | <p>No action is necessary during prep run.</p>                                                                                                                                                                                                   | <p>No action is necessary during prep run. However, if you want the TRACE GC Ultra to wait additional time for an external device such as an MS, turn on the Ready delay feature in the <b>CONFIG»OVEN</b> menu.</p> <p style="text-align: center;"></p> <p>More information is available about Ready delay in <i>Configuration</i> in the TRACE GC Ultra <i>Operating Manual</i>.</p> |
| <p> <b>NOTE</b> The <b>STATUS</b> key is useful during <b>NOT READY</b> to see a list of conditions which are preventing the instrument from going to <b>STANDBY</b>.</p> |                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |

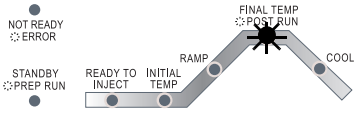
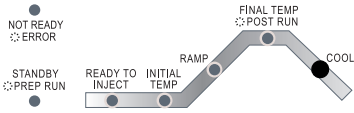
Table 3-1. Steps in a TRACE GC Ultra Run (Continued)

| TRACE GC Ultra Status                                                                                                                                                                                                           | Manual Control                                                                                                                                                                                             | Automated Control                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p><b>READY TO INJECT</b></p>  <p>The Ready-to Inject LED lights when the prep run has finished.</p>                                           | <p>Inject a sample.</p>                                                                                                   | <p>You can control all autosampler functions except alignment from the TRACE GC Ultra. Press <b>AUTOSAMPLER</b> to see the injection options.</p>  <p>You can specify all features on this menu in an analytical method. You can set up an autosampler sequence to direct how a series of samples should be injected and run.</p> <p>More information is available in Sections VI and VIII in the TRACE GC Ultra <i>Operating Manual</i>.</p> |
|                                                                                                                                                                                                                                 | <p>Press <b>START</b>.</p>                                                                                               | <p>You can automatically start the TRACE GC Ultra by specifying an external device to start the TRACE GC Ultra. Ask your Thermo Fisher Scientific field service representative to help you set up an External Event.</p>                                                                                                                                                                                                                                                                                                        |
| <p><b>INITIAL TEMP</b></p>  <p>The Initial Temp LED lights after injection. It stays lit while the initial temperature remains constant.</p> | <p>Press <b>OVEN</b> and edit the Initial Hold menu item to change the hold time for the initial oven temperature.</p>  | <p>You can include the initial holding time as part of the method. More information is available about initial conditions in Chapter 28, <i>Using Analytical Methods</i> in the TRACE GC Ultra <i>Operating Manual</i>.</p>                                                                                                                                                                                                                                                                                                     |

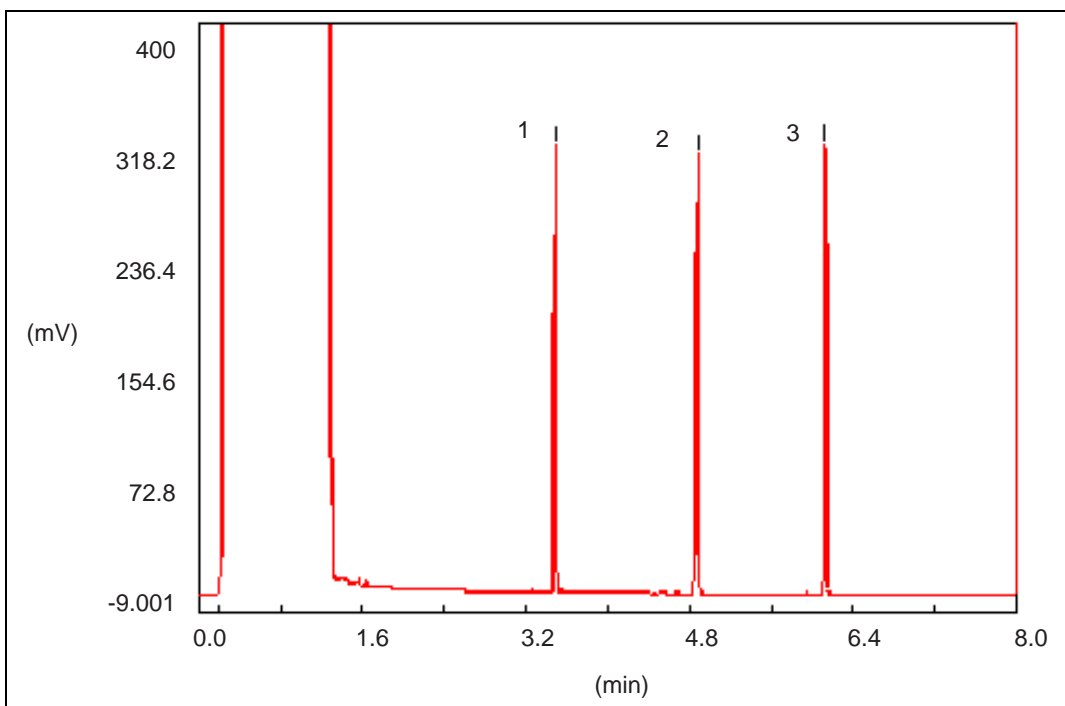
**Table 3-1.** Steps in a TRACE GC Ultra Run (Continued)

| TRACE GC Ultra Status                                                                                                                                                                                                                           | Manual Control                                                                                                                                                                                                                                                                                                                      | Automated Control                                                                                                                                                                                       |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p><b>RAMP</b></p>  <p>The Ramp LED lights when the temperature begins to rise in the first ramp. It stays on throughout the run's temperature variations.</p> | <p>You can specify up to seven temperature changes with holding times. Press <b>OVEN</b> to program ramps.</p> <p style="text-align: center;"></p>                                                                                                 | <p>You can program ramps into the method. More information is available about ramps in <i>Using Analytical Methods</i> in the TRACE GC Ultra <i>Operating Manual</i>.</p>                               |
|                                                                                                                                                                                                                                                 | <p> <b>NOTE</b></p> <p>Depending on the installed inlet options, you may be able to program pressure ramps in addition to temperature ramps. More information is available about pressure ramps in the TRACE GC Ultra <i>Operating Manual</i>.</p> |                                                                                                                                                                                                         |
| <p><b>FINAL TEMP</b></p>  <p>The Final Temp LED lights when the last ramp's temperature is reached and stays on during the last ramp's holding time.</p>     | <p>If you want to change the final holding time, press <b>OVEN</b> and edit the last ramp's Final time.</p> <p style="text-align: center;"></p> <p>You can specify post run actions if you have not already done so.</p>                         | <p>You can program temperature rises and holding times into the method. More information is available about ramps in <i>Using Analytical Methods</i> in the TRACE GC Ultra <i>Operating Manual</i>.</p> |

**Table 3-1.** Steps in a TRACE GC Ultra Run (Continued)

| TRACE GC Ultra Status                                                                                                                                                                                                                                  | Manual Control                                                                   | Automated Control                                                                                                                             |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------|
| <p><b>POST RUN</b></p>  <p>This LED blinks while the TRACE GC Ultra performs any post run activities specified in the <b>OVEN</b> menu, such as a column bakeout.</p> | <p>No action is necessary.</p>                                                   | <p>No action is necessary.</p>                                                                                                                |
| <p><b>COOL</b></p>  <p>The TRACE GC Ultra returns to initial temperature and pressure conditions during this stage.</p>                                               | <p>No action is necessary. However, you can set up conditions for a new run.</p> | <p>No action is necessary. However, you can load or program a new sequence. Your last sequence could have specified a new method to load.</p> |

If you analyzed the calibration mixture for an FID, the resulting chromatogram should resemble the one shown in Figure 3-3 below.



**Figure 3-3.** Chromatogram for Thermo Fisher Scientific Calibration Mixture for an FID Detector

The three peaks correspond to those found in normal hexane:

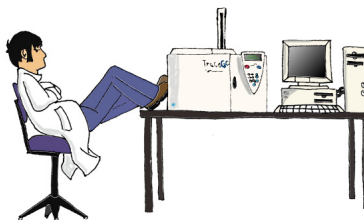
1. dodecane
2. tetradecane
3. hexadecane



### ***Do you want to know more?***

For more information on the keys and LEDs, see Chapter 2, *The TRACE User Interface* in the *TRACE GC Ultra Operating Manual*.





# 4

## Automating Your Analyses

This chapter discusses the basics of automation in analytical methods and autosampler sequences. After you have confirmed the TRACE GC's proper operation, you will probably want to automate many features.

### **Chapter at a Glance...**

|                                                       |    |
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| <a href="#">Developing an Analytical Method</a> ..... | 35 |
| <a href="#">Autosampler Sequence Basics</a> .....     | 37 |

## Developing an Analytical Method

---

An analytical method describes the treatment a sample receives during analysis. You can set parameters for:

- temperatures, including seven programmed changes (ramps)
- pressures
- flow rates
- inlet types
- detector types and parameters
- signal changes
- autosampler parameters
- timed events before, during, and after the run

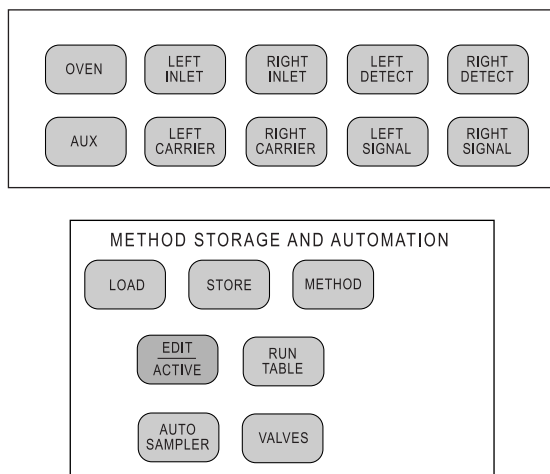
You can store the methods you develop in the TRACE GC's memory or in the data system. The TRACE GC Ultra can hold up to 10 saved methods.

Figure 4-1 shows the keys you could use in developing a method. Pressing a key brings up a menu of choices related to the key name.

When you have set the parameters you want, store the method as follows:

1. Press **METHOD**.
2. Enter a number between 1 and 10 to denote the memory location where the method is to be saved.
3. Press **STORE**.

Later you will load the method by referring to its number.



**Figure 4-1.** Keys Used in Developing an Analytical Method

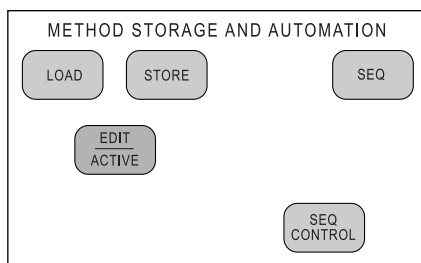
# Autosampler Sequence Basics

If you are using an autosampler, you can develop up to five sequences to describe how samples should be injected and what methods to use during analysis. You can store additional sequences in the data system.

Each sequence has the following areas of dialog:

- Subsequence, for using different methods for groups of samples in the tray
- Post sequence, for repeating the sequence and loading a new method
- Priority, only for AS 2000 autosampler, for interrupting a running sequence with a priority sample

Figure 4-2 shows the keys you would use to develop and run a sequence.



**Figure 4-2.** Keys Used in Developing an Autosampler Sequence



## NOTE

The **EDIT/ACTIVE** key allows you create and edit methods and sequences while a sequence is running. Your changes do not affect the current run.

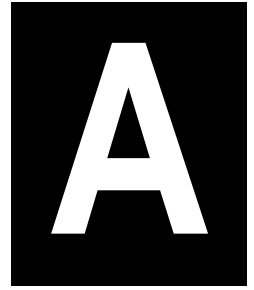
When you have set the parameters you want, save the method as follows:

1. Press **SEQ**.
2. Enter a number between 1 and 5 to denote the memory location where the method is to be saved.
3. Press **STORE**.



***Do you want to know more?***

For more information on developing a method or a sequence, see Section VIII, *Methods and Sequences* in the TRACE GC Ultra *Operating Manual*.



# Customer Communication

Thermo Fisher Scientific provides comprehensive technical assistance worldwide and is dedicated to the quality of our customer relationships and services.

## How To Contact Us

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This appendix contains contact information for Thermo Fisher Scientific office. Use the list reported in *Customer Communication* to contact your local Thermo Fisher Scientific office or affiliate.

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This appendix also contains a one-page [Reader Survey](#). Use this survey to give us feedback on this manual and help us improve the quality of our documentation

## Reader Survey

**Product:** TRACE GC Ultra

**Manual:** Getting Started

**Part No.:** M31709230

**Please help us improve the quality of our documentation by completing and returning this survey.  
Circle one number for each of the statements below.**

|                                                     | Strongly<br>Agree | Agree | Neutral | Disagree | Strongly<br>Disagree |
|-----------------------------------------------------|-------------------|-------|---------|----------|----------------------|
| The manual is well organized.                       | 1                 | 2     | 3       | 4        | 5                    |
| The manual is clearly written.                      | 1                 | 2     | 3       | 4        | 5                    |
| The manual contains all the information I need.     | 1                 | 2     | 3       | 4        | 5                    |
| The instructions are easy to follow.                | 1                 | 2     | 3       | 4        | 5                    |
| The instructions are complete.                      | 1                 | 2     | 3       | 4        | 5                    |
| The technical information is easy to understand.    | 1                 | 2     | 3       | 4        | 5                    |
| Examples of operation are clear and useful.         | 1                 | 2     | 3       | 4        | 5                    |
| The figures are helpful.                            | 1                 | 2     | 3       | 4        | 5                    |
| I was able to install the system using this manual. | 1                 | 2     | 3       | 4        | 5                    |

**If you would like to make additional comments, please do. (Attach additional sheets if necessary.)**

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This section contains an alphabetical list and descriptions of terms used in this guide and the help diskette. This also includes abbreviations, acronyms, metric prefixes, and symbols.

## A

|     |                             |
|-----|-----------------------------|
| A   | ampere                      |
| ac  | alternating current         |
| ADC | analog-to-digital converter |

## B

|           |                                              |
|-----------|----------------------------------------------|
| b         | bit                                          |
| B         | byte (8 b)                                   |
| baud rate | data transmission speed in events per second |

## C

|     |                                         |
|-----|-----------------------------------------|
| °C  | Celsius                                 |
| CIP | Carriage and Insurance Paid To          |
| cm  | centimeter                              |
| CPU | central processing unit (of a computer) |
| CSE | Customer Service Engineer               |

## D

|     |                             |
|-----|-----------------------------|
| d   | depth                       |
| DAC | digital-to-analog converter |
| dc  | direct current              |
| DS  | data system                 |

## Glossary

### E

|     |                               |
|-----|-------------------------------|
| ECD | Electron Capture Detector     |
| EMC | electromagnetic compatibility |
| ESD | electrostatic discharge       |

### F

|     |                            |
|-----|----------------------------|
| °F  | Fahrenheit                 |
| FID | Flame Ionization Detector  |
| FOB | Free on Board              |
| FPD | Flame Photometric Detector |
| ft  | foot                       |

### G

|     |                   |
|-----|-------------------|
| g   | gram              |
| GC  | gas chromatograph |
| GND | electrical ground |

### H

|                     |                                                                                       |
|---------------------|---------------------------------------------------------------------------------------|
| <i>h</i>            | height                                                                                |
| h                   | hour                                                                                  |
| harmonic distortion | A high-frequency disturbance that appears as distortion of the fundamental sine wave. |
| HV                  | high voltage                                                                          |
| Hz                  | hertz (cycles per second)                                                             |

**I**

|         |                                           |
|---------|-------------------------------------------|
| IEC     | International Electrotechnical Commission |
| impulse | See <i>transient</i>                      |
| in.     | inch                                      |
| I/O     | input/output                              |

**K**

|     |                        |
|-----|------------------------|
| k   | kilo ( $10^3$ or 1024) |
| K   | Kelvin                 |
| kg  | kilogram               |
| kPa | kilopascal             |

**L**

|          |                      |
|----------|----------------------|
| <i>l</i> | length               |
| l        | liter                |
| lb       | pound                |
| LAN      | Local Area Network   |
| LED      | light-emitting diode |

**M**

|       |                                |
|-------|--------------------------------|
| m     | meter (or milli [ $10^{-3}$ ]) |
| M     | mega ( $10^6$ )                |
| $\mu$ | micro ( $10^{-6}$ )            |
| min   | minute                         |
| mL    | milliliter                     |
| mm    | millimeter                     |

## Glossary

|              |                                                                                                    |
|--------------|----------------------------------------------------------------------------------------------------|
| m/z          | mass-to-charge ratio                                                                               |
| <b>N</b>     |                                                                                                    |
| n            | nano ( $10^{-9}$ )                                                                                 |
| NPD          | Nitrogen Phosphorous Detector                                                                      |
| <b>O</b>     |                                                                                                    |
| $\Omega$     | ohm                                                                                                |
| <b>P</b>     |                                                                                                    |
| p            | pico ( $10^{-12}$ )                                                                                |
| Pa           | pascal                                                                                             |
| PCB          | printed circuit board                                                                              |
| PDD          | Pulsed Discharge Detector                                                                          |
| PID          | Photo Ionization Detector                                                                          |
| psi          | pounds per square inch                                                                             |
| <b>R</b>     |                                                                                                    |
| RAM          | random access memory                                                                               |
| RF           | radio frequency                                                                                    |
| ROM          | read-only memory                                                                                   |
| RS-232       | industry standard for serial communications                                                        |
| <b>S</b>     |                                                                                                    |
| s            | second                                                                                             |
| sag          | See <i>surge</i>                                                                                   |
| slow average | A gradual, long-term change in average RMS voltage level, with typical durations greater than 2 s. |

|           |                                                                                                 |
|-----------|-------------------------------------------------------------------------------------------------|
| SOP       | Standard Operating Procedure                                                                    |
| surge     | A sudden change in average RMS voltage level, with typical duration between 50 $\mu$ s and 2 s. |
| <b>T</b>  |                                                                                                 |
| TCD       | Thermal Conductivity Detector                                                                   |
| transient | A brief voltage surge of up to several thousand volts, with a duration of less than 50 $\mu$ s. |
| <b>U</b>  |                                                                                                 |
| UFM       | Ultra Fast Module                                                                               |
| <b>V</b>  |                                                                                                 |
| V         | volt                                                                                            |
| V ac      | volts, alternating current                                                                      |
| V dc      | volts, direct current                                                                           |
| VGA       | Video Graphics Array                                                                            |
| <b>W</b>  |                                                                                                 |
| <i>w</i>  | Width                                                                                           |
| W         | Watt                                                                                            |



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