

Agilent 490 Micro GC Biogas Analyzers

User Manual



Agilent Technologies

Notices

© Agilent Technologies, Inc. 2012

No part of this manual may be reproduced in any form or by any means (including electronic storage and retrieval or translation into a foreign language) without prior agreement and written consent from Agilent Technologies, Inc. as governed by United States and international copyright laws.

Manual Part Number

G3582-90000

Edition

Second edition, February 2012

Printed in USA

Agilent Technologies, Inc.
2850 Centerville Road
Wilmington, DE 19808-1610 USA

Warranty

The material contained in this document is provided “as is,” and is subject to being changed, without notice, in future editions. Further, to the maximum extent permitted by applicable law, Agilent disclaims all warranties, either express or implied, with regard to this manual and any information contained herein, including but not limited to the implied warranties of merchantability and fitness for a particular purpose. Agilent shall not be liable for errors or for incidental or consequential damages in connection with the furnishing, use, or performance of this document or of any information contained herein. Should Agilent and the user have a separate written agreement with warranty terms covering the material in this document that conflict with these terms, the warranty terms in the separate agreement shall control.

Technology Licenses

The hardware and/or software described in this document are furnished under a license and may be used or copied only in accordance with the terms of such license.

Restricted Rights Legend

If software is for use in the performance of a U.S. Government prime contract or sub-contract, Software is delivered and licensed as “Commercial computer software” as defined in DFAR 252.227-7014 (June 1995), or as a “commercial item” as defined in FAR 2.101(a) or as “Restricted computer software” as defined in FAR 52.227-19 (June 1987) or any equivalent agency regulation or contract clause. Use, duplication or disclosure of Software is subject to Agilent Technologies’ standard commercial license terms, and non-DOD Departments and Agencies of the U.S. Government will receive no greater than Restricted Rights as defined in FAR 52.227-19(c)(1-2) (June 1987). U.S. Government users will receive no greater than Limited Rights as defined in FAR 52.227-14

(June 1987) or DFAR 252.227-7015 (b)(2) (November 1995), as applicable in any technical data.

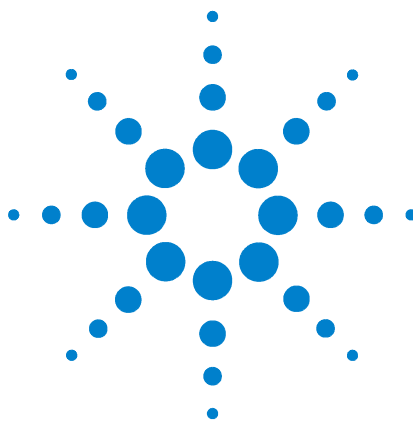
Safety Notices

CAUTION

A **CAUTION** notice denotes a hazard. It calls attention to an operating procedure, practice, or the like that, if not correctly performed or adhered to, could result in damage to the product or loss of important data. Do not proceed beyond a **CAUTION** notice until the indicated conditions are fully understood and met.

WARNING

A **WARNING** notice denotes a hazard. It calls attention to an operating procedure, practice, or the like that, if not correctly performed or adhered to, could result in personal injury or death. Do not proceed beyond a **WARNING** notice until the indicated conditions are fully understood and met.



The Agilent Biogas Analyzers

Biogas is a type of biofuel produced by the biological breakdown of organic material in an anaerobic environment. The anaerobic digestion or fermentation process of biodegradable materials such as manure, sewage, municipal waste, green waste, plant material, or crops produces biogas. Biogas is composed of methane, carbon monoxide, hydrogen, carbon dioxide, nitrogen, hydrogen sulfide, and oxygen. When methane, hydrogen, and carbon monoxide are combusted or oxidized with oxygen, energy is produced that can be used as fuel.

The Agilent 490 Micro GC Biogas Analyzer is a factory tuned analyzer specific for biogas analysis.

Two types of Biogas Analyzers are available: Agilent 490 Micro GC Biogas Analyzer and the Agilent 490 Micro GC Biogas Analyzer Extended. The choice of configuration depends on the type of biogas sample.

Biogas Analyzer

The Agilent 490 Micro GC Biogas Analyzer is used to analyze pure biogas including analysis of permanent gases, hydrogen sulfide and hydrocarbons up to n-propane. This is a dual cabinet equipped with a CP-Molsieve 5A channel and a CP-PoraPLOT U channel with dual carrier gas option.

Biogas Analyzer Extended

The Agilent 490 Micro GC Biogas First edition, December 2011 Analyzer Extended is used to analyze biogas mixed with other hydrocarbon streams. The analysis consists of permanent gases, hydrogen sulfide and hydrocarbons up to n-heptane. The Biogas Analyzer Extended is a quad cabinet equipped with three channels: a CP-Molsieve 5A, a CP-PoraPLOT U channel and a CP-Sil 5 CB channel with dual carrier gas option.

Before starting up the Analyzer make sure that correct carrier gases are connected for all channels. Argon carrier gas is required for the CP-Molsieve channel and Helium for all other channels. The required pressure for all carrier gases is 550 kPa (80 psi). More detail concerning the Agilent Micro GC can be found in the Agilent 490 Micro GC user manual.



Checkout information

The Biogas Analyzer is factory tuned including appropriate settings for backflush times for the CP- Molsieve 5A and CP-PoraPLOT U channel. Final checkout of the Agilent 490 Micro GC Biogas Analyzers is performed with a Universal Gas Calibration standard. This contains helium, neon, hydrogen, oxygen, nitrogen, methane, ethane, ethylene, carbon dioxide, carbon monoxide, acetylene, n-propane, methyl acetylene and n-butane. Not all components of this Calibration Standard are specified for the Biogas Analyzers. This calibration standard is used as a reference for the performance of the Biogas Analyzer. For more details regarding the Universal Gas Calibration Standard, see Appendix 1.

The Universal Gas Calibration Standard is shipped with the Analyzer and will be used by the Agilent Customer Engineer at installation. The factory tuned method, final chromatogram (Test Report) and this Biogas Analyzer user manual are supplied with the Biogas Analyzer on the analyzer CD.

Use the Universal Gas Calibration Standard to perform reference checks on the Biogas Analyzer. Load the method from the Analyzer CD if Openlab CDS EZChrom Edition is used or create a method using the settings from the method PDF file on the Analyzer CD. For a quick start, see Appendix 2. Connect and inject the Calibration Standard.

The Universal Gas Calibration Standard does not contain hydrogen sulfide, neo-pentane, n-pentane or i-pentane. For these components, reference chromatograms are included in this manual.

CP-Molsieve channel

The CP-Molsieve 5A channel of the Biogas Analyzer analyzes permanent gases such as helium, neon, hydrogen, oxygen, nitrogen, methane and carbon monoxide.

Figure 1 is a chromatogram of the Universal gas Calibration Standard analyzed on the CP-Molsieve 5A channel.

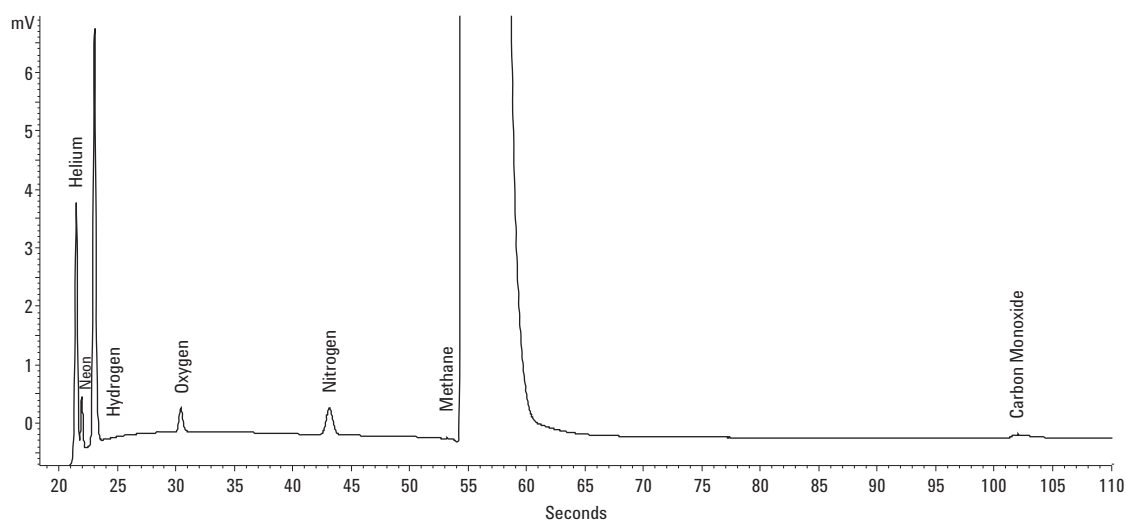


Figure 1 The Universal Gas Calibration Standard analyzed on the CP-Molsieve channel

CP-PoraPLOT U channel

The CP-PoraPLOT U channel of the Biogas Analyzer is used to analyze carbon dioxide, ethane, hydrogen sulfide and n-propane. This channel and the sample inlet are Ultimetel deactivated which results in improved performance for hydrogen sulfide analysis.

The chromatogram obtained from the Universal Gas Calibration Standard with the CP-PoraPLOT U is shown in [Figure 2](#).

If a sample contains hydrogen sulfide, the chromatogram resembles [Figure 3](#).

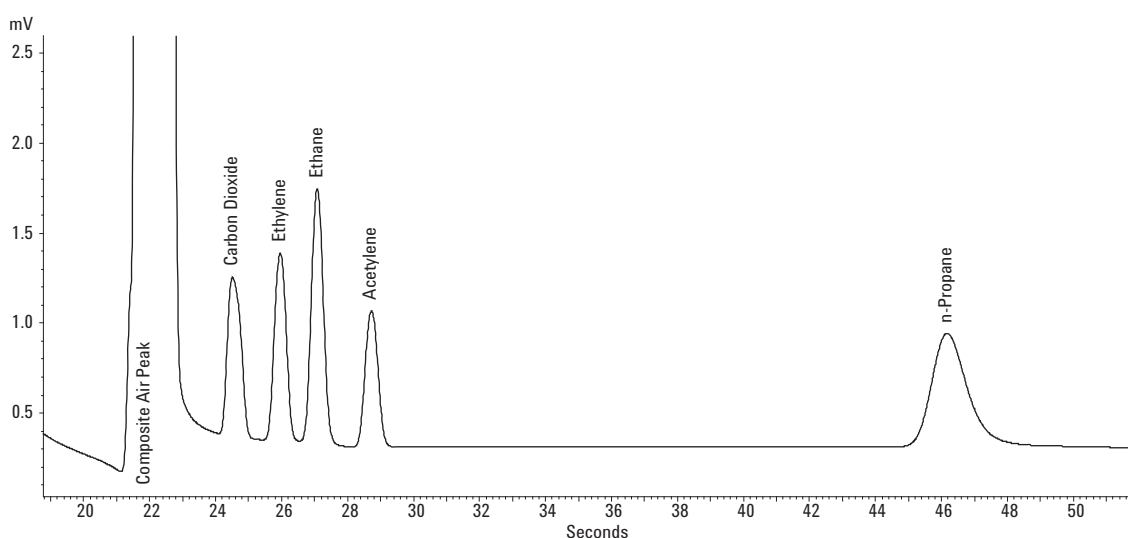


Figure 2 The Universal Gas Calibration Standard analyzed on the CP-PoraPLOT U channel

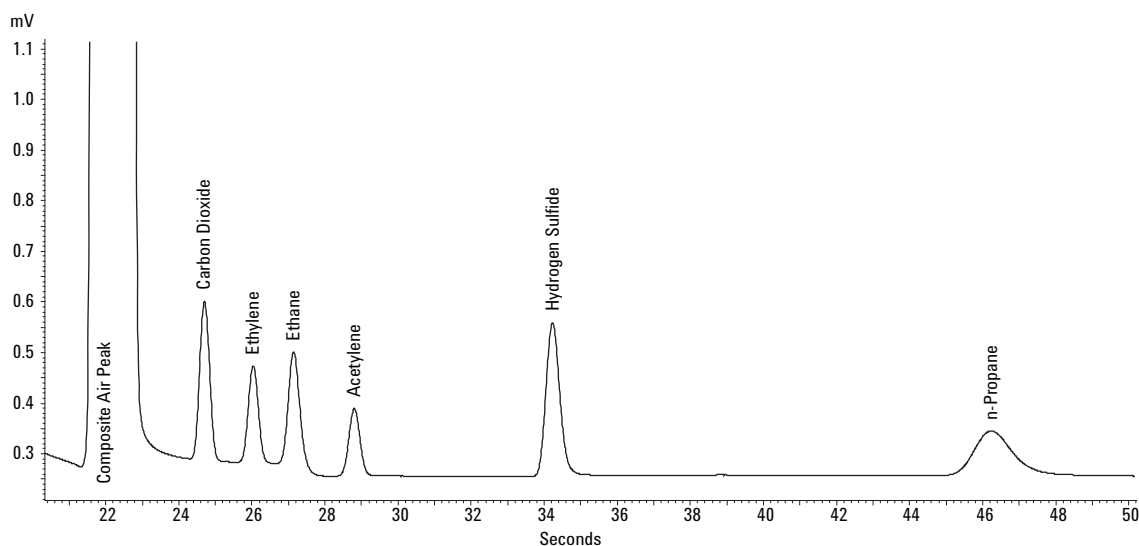


Figure 3 A mixture with hydrogen sulfide analyzed on the CP-PoraPLOT U channel

CP Sil 5 CB channel

The CP-Sil 5 CB channel of the Biogas Analyzer Extended is used to analyze the hydrocarbon up to n-heptane. Hydrocarbons that are specified for this analyzer are i-butane, n-butane, neo-pentane, n-pentane, iso-pentane, n-hexane, and n-heptane. The Universal Gas Calibration Standard does not contain all these hydrocarbons. A reference chromatogram is included in this manual for the missing components.

Analyzing the Universal Gas Calibration Standard with the CP-Sil 5 CB results in the chromatogram shown in [Figure 4](#).

If a hydrocarbon mixture up to n-hexane is used, the chromatogram resembles [Figure 5](#).

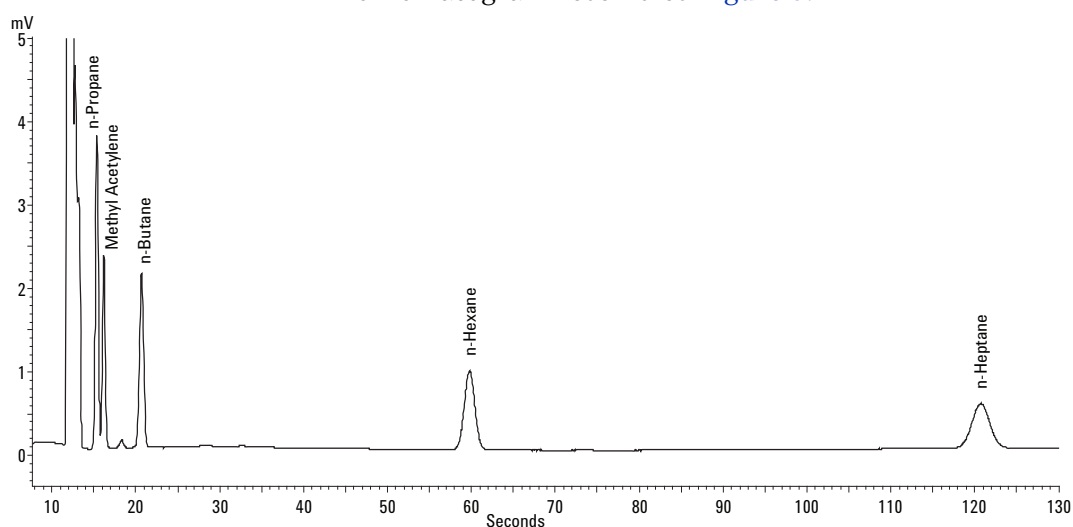


Figure 4 The Calibration Standard analyzed on CP-Sil 5 CB channel

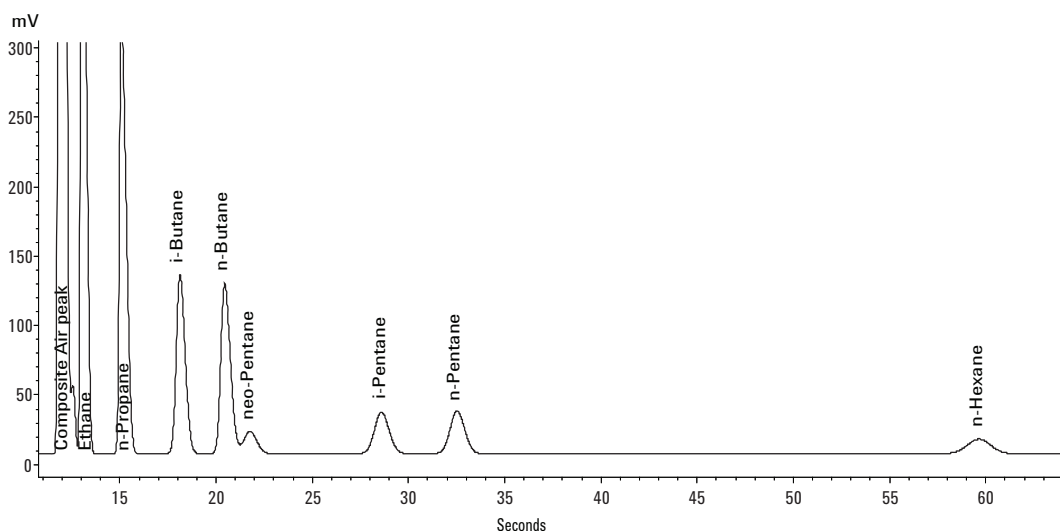


Figure 5 A hydrocarbon mixture up to n-Hexane analyzed on the CP-Sil 5 CB channel

Tuning the backflush time

For the CP-Molsieve 5A and the CP-PoraPLOT U channel, the backflush times must be tuned. For tuning, the Universal Gas Calibration Standard is recommended.

The purpose of tuning the CP-Molsieve 5A is to get all methane on the column while all components such as moisture, carbon dioxide, ethane and higher hydrocarbons are backflushed. The CP-PoraPLOT U is tuned on the n-Propane peak while all other hydrocarbons that elute after it are backflushed.

- 1 Set the backflush time at 0 second and analyze the Calibration standard. The purpose of this is to identify the components in the Standard.
- 2 Change the backflush time. Start with 10 seconds and make a run. Now the following can be observed:
 - When the backflush time is set too early you will see the peak of interest partially or totally backflushed.
 - If the backflush time is set too late the unwanted components are not backflushed.
- 3 Adjust the backflush time until a huge difference is noticed in the peak of interest. Then make smaller steps (0.1 seconds) until the optimal backflush time is found.

Figure 6 shows a simple example of tuning the backflush time for the CP-Molsieve 5A channel.

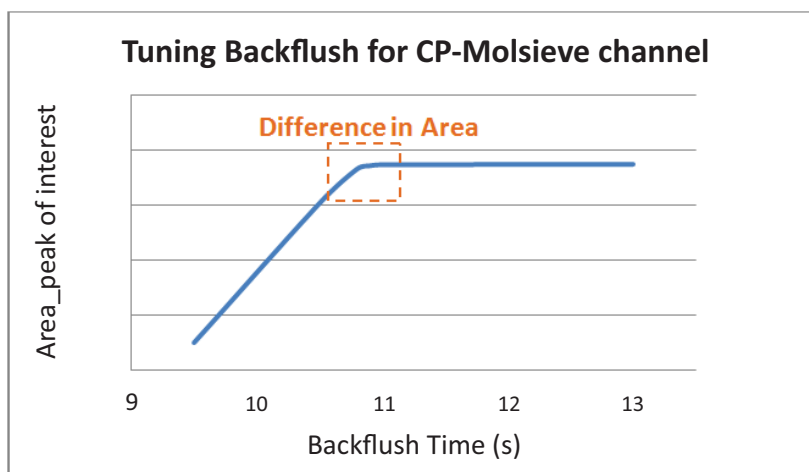


Figure 6 Effect of backflush time on the peak of interest

Appendix 1: Certificate of the Universal Gas Calibration Standard

Part No: 5184-3541 Part No. Kit: 5184-3546



Agilent Technologies
Innovating the HP Way



Certificate of Analysis

Universal Gas Calibration Standard

Agilent Part No: 5183-4800, 5184-3541

Sample Lot No: 021510U

Concentrations (\pm mole%):

Helium	0.1000% (\pm 5%)	n-Hexane	0.0500% (\pm 5%)
Neon	0.0496% (\pm 5%)	n-Heptane	0.0500% (\pm 5%)
Hydrogen	0.0988% (\pm 5%)	Water content (H ₂ O)	<5 ppm
Oxygen	0.0500% (\pm 5%)	Other impurities (HC's)	<1 ppm
Nitrogen	0.1000% (\pm 5%)		
Methane	Balance		
Ethane	0.0497% (\pm 5%)		
Ethylene	0.0497% (\pm 5%)		
Carbon Dioxide	0.0500% (\pm 5%)		
Carbon Monoxide	0.0995% (\pm 5%)		
Acetylene	0.0494% (\pm 5%)		
Propane	0.0501% (\pm 5%)		
Methyl Acetylene	0.0501% (\pm 5%)		
n-Butane	0.0501% (\pm 5%)		

Traceability:

This standard was produced gravimetrically following Specialty Gas Work Instruction #15. Balances used are calibrated per POIS 2.140, traceable to NIST. Concentrations were verified on an Agilent model 6890 gas chromatograph, using a Wasson valve switch, Variable Pressure Control and multiple packed/capillary columns.

Standards Used:

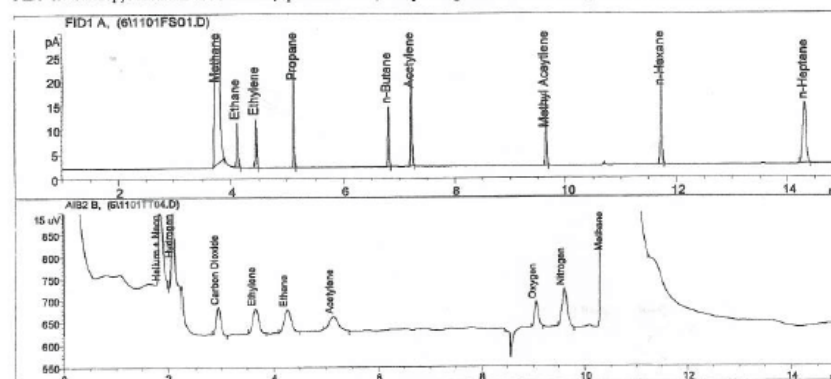
Praxair UGS Primary Standard, serial # CC309710

Analytical GC Chromatogram:

Analytical columns: Agilent MS-5A PLOT, U-PLOT

TCD: 1.0 ml loop; He carrier at 35 ml/min; oven temp = 90degC

FID: 0.1 ml loop; He carrier at 30 ml/min; split ratio=25:1; Ramp 75degC for 6 min to 180degC for 3.75 min at 20degC/min



Date of Release: 15 February, 2010
Expiration Date: 15 February, 2012

Analyst: John Goddard
Senior Chemist *John Goddard*

Appendix 2: The Biogas Analyzer method

Table 1 The Biogas Analyzer method

Method Settings	CP-Molsieve 5A	CP-PoraPLOT U	CP-Sil 5 CB
Carrier gas	Argon	Helium	Helium
Injector Temperature (°C)	110	110	110
Injection Time (ms)	40	40	40
Backflush time (s)	11	14	-
Column Temperature (°C)	80	80	60
Pressure (kPa)	200	150	150
Sample Line temperature (°C)	110	110	110
Invert signal	Yes	No	No

For more details of the method see the PDF method file available on the analyzer CD.

The backflush time must be tuned for each new CP-Molsieve and CP-PoraPLOT channel.



Agilent Technologies

© Agilent Technologies, Inc.

Printed in USA, February 2012



G3582-90000