

GC Solution for Petrochemical Applications

# Analysis of Natural Gas with Shimadzu System GC



# Introduction

Shimadzu System GC provides a highly flexible GC analysis platform to obtain comprehensive characterization and quantitative information, including hydrocarbon group types of oxygenates and carbon numbers. The methods for determining the chemical composition of

natural gases, such as the analysis system and similar gaseous mixtures within the composition range, are shown in the specification sheet. Excellent functions, such as the Digital Flow Controller, have been adopted and the reliability and accuracy improved.

## System GC Lineup & Features

Shimadzu is offering 6 standard GC systems for natural gas analysis according to the target compound and standard method, such as ASTM, GPA.

NGA Analysis System Line Up						
Model Name	GC-2014NGA1	GC-2014NGA2	GC-2014FNGA1	GC-2014FNGA2	GC-2014ENGA1	GC-2014ENGA2
Standard Method	ASTM-D1945 ASTM-D3588 GPA-2261	ASTM-D1945 ASTM-D3588	ASTM-D1945 ASTM-D3588 GPA-2261	ASTM-D1945 ASTM-D3588 GPA-2261	—	—
Valve Numbers	3	2	4	3	4	4
Column Numbers	6	4	8	6	7	7
Type of Detector	Dual TCD	TCD	Dual TCD, FID	TCD, FID	Dual TCD, FID	Dual TCD, FID
Target Compounds	He, H <sub>2</sub> , O <sub>2</sub> , N <sub>2</sub> , CH <sub>4</sub> , CO, CO <sub>2</sub> , C <sub>2</sub> -C <sub>5</sub> , H <sub>2</sub> S, C <sub>6</sub> <sup>+</sup>	O <sub>2</sub> , N <sub>2</sub> , CH <sub>4</sub> , CO, CO <sub>2</sub> , C <sub>2</sub> -C <sub>5</sub> , H <sub>2</sub> S, C <sub>6</sub> <sup>+</sup>	He, H <sub>2</sub> , O <sub>2</sub> , N <sub>2</sub> , CH <sub>4</sub> , CO, CO <sub>2</sub> , C <sub>2</sub> -C <sub>5</sub> , H <sub>2</sub> S, C <sub>6</sub> <sup>+</sup>	O <sub>2</sub> , N <sub>2</sub> , CH <sub>4</sub> , CO, CO <sub>2</sub> , C <sub>2</sub> -C <sub>5</sub> , H <sub>2</sub> S, C <sub>6</sub> <sup>+</sup>	He, H <sub>2</sub> , O <sub>2</sub> , N <sub>2</sub> , CH <sub>4</sub> , CO, CO <sub>2</sub> , C <sub>2</sub> -C <sub>5</sub> , H <sub>2</sub> S, C <sub>6</sub> -C <sub>13</sub>	He, H <sub>2</sub> , O <sub>2</sub> , N <sub>2</sub> , CH <sub>4</sub> , CO, CO <sub>2</sub> , C <sub>2</sub> -C <sub>5</sub> , H <sub>2</sub> S, C <sub>6</sub> -C <sub>13</sub>
Analysis Time	17 minutes	17 minutes	10 minutes	10 minutes	40 minutes	30 minutes

### NGA

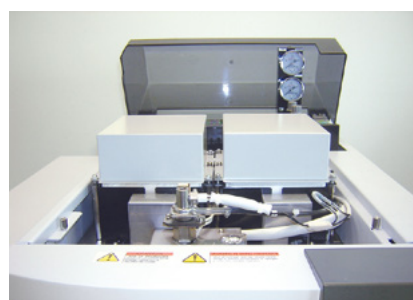
- Three 10-port valves, 2 TCDs and three packed main columns are used. (Compliance with ASTM-1945)
- Approximate analysis time is 17 min.

### Extended NGA

- ENGA system uses one GC oven (single oven) with Rtx-1 capillary column for C<sub>3</sub> to C<sub>13</sub>.
- Split/Splitless injector is installed to split the sample and to inject the liquid standard sample.
- Two TCDs and one FID are used.
- A system with two GC ovens (dual oven) for extended fast NGA is also available for more flexible separation of hydrocarbons.

### Fast NGA

- Capillary columns are adopted to reduce the analysis time without sacrificing separation performance.
- 3 or 4 10-port valves are used.
- Two TCDs (FNGA1) and one FID are used.
- Approximate analysis time is 10 minutes.



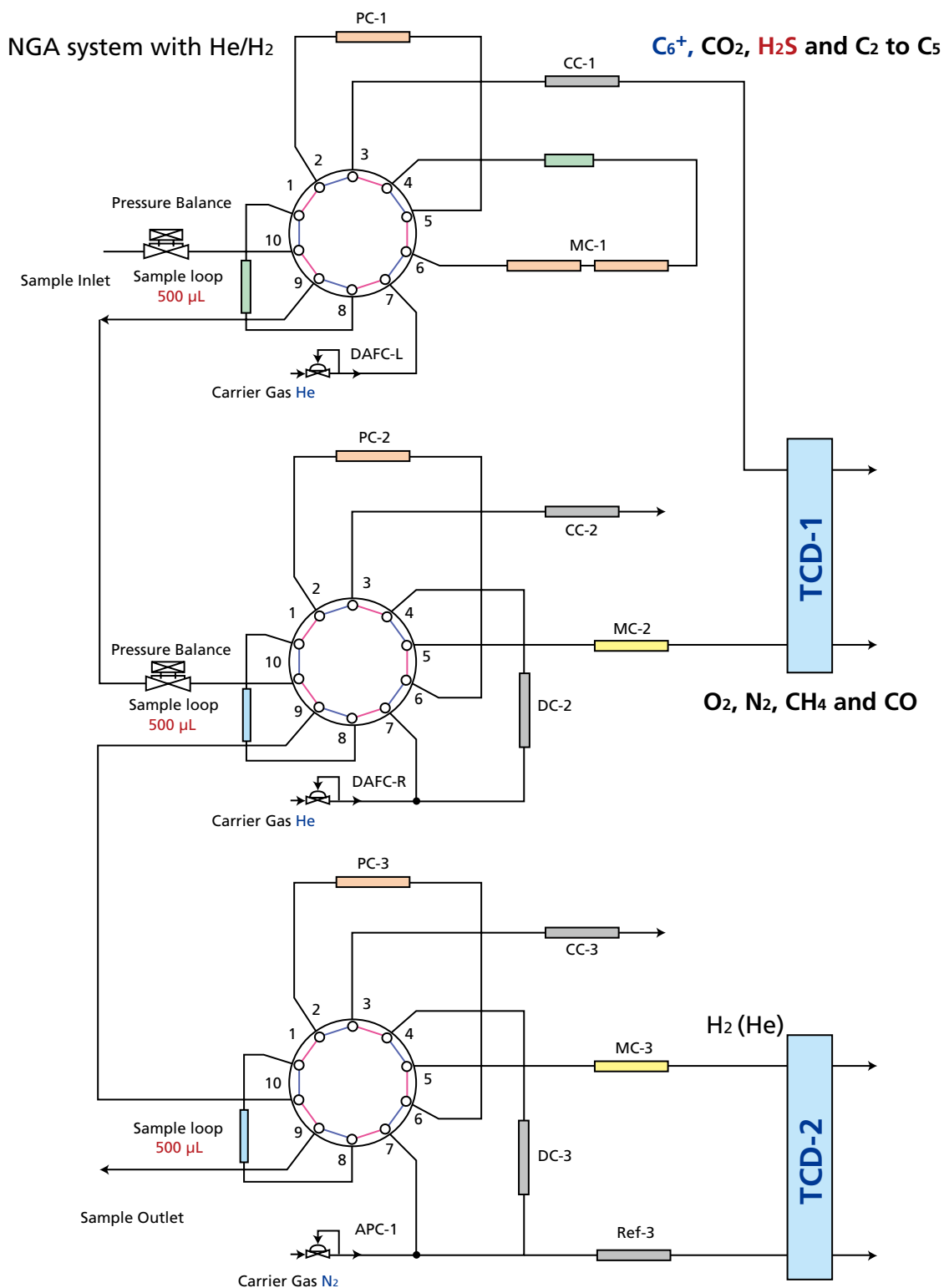
Dual TCD + Single FID

# Concept of Flow Diagram

The flow diagram concept for Shimadzu system GCs is simple to ensure easy maintenance.

Some of the systems may have 4 switching valves. Although it looks complicated, the system may have independent flow lines.

Since these independent flow lines have specific separation columns to separate specific target samples, it will be easy to adjust the optimum separation conditions for each independent flow line and perform maintenance.



# Features & Benefits

## Digital flow control

In order to obtain excellent retention time repeatability, an advanced flow controller (AFC) or advanced pressure controller (APC) is used to control the carrier gas flow rate and pressure precisely.

## Delay injection technique

To keep good peak shape, additional empty pipe, which causes peak broadening, to adjust the time is not required.

## Backflush technique

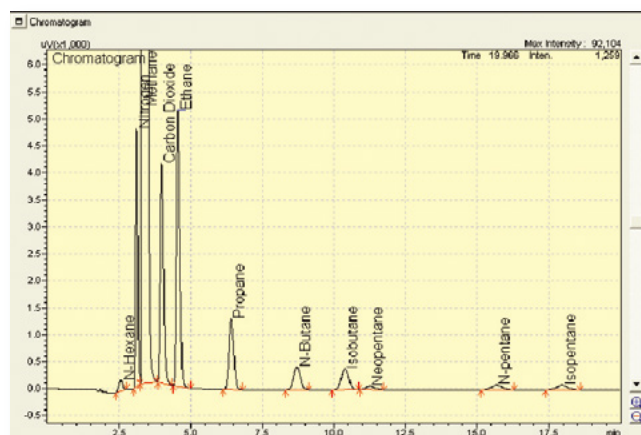
In order to shorten analysis times, protect the column and prevent contamination in the detector, System GC systems are equipped with the Backflush device.

## Calorific value calculation software for ISO, BTU

System GC is equipped with software that outputs reports according to ISO, BTU requirements.

## A single vendor solution

All Shimadzu GCs are built and tested at our factory using Shimadzu components. On-site installation and performance verification is performed by Shimadzu-trained and certified engineers.



**GC Analysis BTU Calculation Report**

Data file name : D:\465-01081 India-C11484535004CS\0710\NGA-070711-03.gcd  
 Date of analysis : 2007-7-11 10:32:57  
 Sample Gas : NGA  
 Operated by : MR-A

No	COMPONENT	Conc	BTU*	SP GR*	MOL F%
1	C5+	0.00461	22.82	0.0143	0.46%
2	CH4	0.77740	786.17	0.4306	78.43%
3	C2H6	0.01880	33.28	0.0105	1.90%
4	C3H8	0.00970	24.41	0.0148	0.98%
5	i-BUTANE	0.00943	30.68	0.0189	0.95%
6	n-BUTANE	0.01010	32.93	0.0203	1.02%
7	i-PENTANE	0.01020	40.81	0.0254	1.03%
8	n-PENTANE	0.00491	19.69	0.0122	0.50%
9	He	0.00000	0.00	0.0000	0.00%
10	H2	0.00000	0.00	0.0000	0.00%
11	O2	0.01111	0.00	0.0123	1.12%
12	N2	0.09705	0.00	0.0939	9.79%
13	CO	0.00938	3.01	0.0091	0.95%
14	CO2	0.01919	0.00	0.0292	1.94%
15	H2S	0.00916	5.84	0.0108	0.92%
<b>TOTAL</b>		<b>0.99123</b>	<b>996.59</b>	<b>0.7112</b>	<b>100.00%</b>

14.696 PSIA DRY & UNCORRECTED FOR COMPRESSIBILITY

COMPRESSIBILITY : 0.9975

DRY BTU CORRECTED FOR COMPRESSIBILITY  
 DRY B.T.U. B3 : 996.0481

DRY BTU CORRECTED FOR COMPRESSIBILITY  
 SA1 B.T.U. B3 : 996.0481

H<sub>2</sub>O/2 dry gas, air : 1001.1451  
 H<sub>2</sub>O/2 Salt/Dry Air : 998.5933  
 Z-Dry Gas : 0.9975  
 G-Dry Gas/Dry Air : 0.7130

REAL SP GRAVITY : 0.5750  
 [STD CONDITIONS = 14.696  
 PAIA corrected for compressibility : SP GR @ AIR = 0.9906]

SPECIFIC GRAVITY RELATIVE TO WATER  
 SP GRAVITY REL H<sub>2</sub>O : 1.0000  
 RELATIVE DENSITY : 0.7112  
 AVERAGE MOL WEIGHT : 20.60

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