

**Shimadzu Gas Chromatograph
Workstation
MDGCsolution
INSTRUCTION MANUAL**

Read the instruction manual thoroughly before you use the product. Keep this instruction manual for future reference.



ANALYTICAL & MEASURING INSTRUMENTS DIVISION

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Introduction

Read this Instruction Manual thoroughly before using the product.

Thank you for purchasing the Shimadzu Gas Chromatograph workstation MDGCSolution. MDGCSolution software is used to control a gas chromatograph (GC) via a personal computer (PC). This software can collect chromatogram or other types of data, then analyze the data in the PC according to a variety of conditions.

This Instruction Manual is designed for the easy understanding of the basic operation of the MDGCSolution software. Read this manual thoroughly before using the product and operate the product in accordance with the instructions in this manual. Also, keep this manual for future reference. This manual also assumes that the reader has previous knowledge of basic Windows operations. For information about Windows operation, please refer to the documentation provided for that product.

IMPORTANT

- If the user or usage location changes, ensure that this Instruction Manual is always kept together with the product.
- If this manual is lost or damaged, immediately contact your Shimadzu representative to request a replacement.
- To ensure safe operation, contact your Shimadzu representative if product installation, adjustment, or re-installation (after the product is moved) is required.

Notice

- Information in this manual is subject to change without notice and does not represent a commitment on the part of the vendor.
- Any errors or omissions which may have occurred in this manual despite the utmost care taken in its production will be corrected as soon as possible, although not necessarily immediately after detection.
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Warranty

Shimadzu provides the following warranty for this product.

1. **Period:** Please contact your Shimadzu representative for information about the period of this warranty.
2. **Description:** If a product/part failure occurs for reasons attributable to Shimadzu during the warranty period, Shimadzu will repair or replace the product/part free of charge. However, in the case of products which are usually available on the market only for a short time, such as personal computers and their peripherals/parts, Shimadzu may not be able to provide identical replacement products.
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 - 2) Repairs or modifications performed by parties other than Shimadzu or Shimadzu designated companies
 - 3) Product use in combination with hardware or software other than that designated by Shimadzu
 - 4) Computer viruses leading to device failures and damage to data and software, including the product's basic software
 - 5) Power failures, including power outages and sudden voltage drops, leading to device failures and damage to data and software, including the product's basic software
 - 6) Turning OFF the product without following the proper shutdown procedure leading to device failures and damage to data and software, including the product's basic software
 - 7) Reasons unrelated to the product itself
 - 8) Product use in harsh environments, such as those subject to high temperatures or humidity levels, corrosive gases, or strong vibrations
 - 9) Fires, earthquakes, or any other act of nature, contamination by radioactive or hazardous substances, or any other force majeure event, including wars, riots, and crimes
 - 10) Product movement or transportation after installation
 - 11) Consumable items

Note: Recording media such as floppy disks and CD-ROMs are considered consumable items.

After-Sales Service and Availability of Replacement Parts

After-Sales Service

If any problem occurs with this product, take appropriate corrective action as described in this manual's "10. Troubleshooting". If the problem persists, or the symptoms are not covered in the troubleshooting section, contact your Shimadzu representative.

Replacement Parts Availability

Replacement parts for this product will be available for a period of seven (7) years after the product is discontinued. Thereafter, such parts may cease to be available. Note, however, that the availability of parts not manufactured by Shimadzu shall be determined by the relevant manufacturers.

MDGCsolution Package Contents



The following disk and accessories are included in the MDGCsolution package.

Item Name	Quantity	Part Number
MDGCsolution CD-ROM	1	223-07253-91
MDGCsolution Instruction Manual	1	223-60084
Registration Card	1	223-60083
Warranty Card	1	223-00132

If this product's package is included as an accessory of a set product, some of the contents may differ. In this case, refer to the set product's Package Contents document for details.

Notation Conventions

This document uses the following notation conventions.

Notation	Meaning
 (Note)	Emphasizes additional information that is provided to ensure the proper use of this product.
 (Reference)	Shows where reference information on the point concerned can be found. If reference information is already included in the sentence, this mark is not used.
[]	Shows a window, view, parameter, tab, column, cell, or bar name, menu command that can be selected from the menu bar.
[]-[]command	Shows a sequence of selecting the menu in the first [] and then selecting the command in the second []. For example, [File]-[Print] command means that you should click on the File menu and then select the Print command from the displayed list of commands.

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Outline

The MDGCsolution application software expands the functions of GCsolution so that it can be used as a multi-dimensional GC (MDGC). When MDGCsolution is installed, a GC-GC or GC-GCMS system mounted with a switching device for a multi-dimensional GC can be used as a multi-dimensional GC. When the switching device is not used and the conventional GCsolution is started up, the system can be used as a standalone GC.

MDGCsolution is provided with a programming function for setting the timing that the switching device is selected. The timing can also be set intuitively by clicking on a chromatogram displayed in the window.

These settings are saved as an MDGCsolution method file. Compared with systems that use exclusive software for controlling the switching device, procedures for setting switching conditions and linking GC control conditions have been made simpler to prevent setup mistakes.

Also, as a feature common to the LabSolutions series, methods that contain these conditions are recorded to data files so that traceability can be more easily ensured.



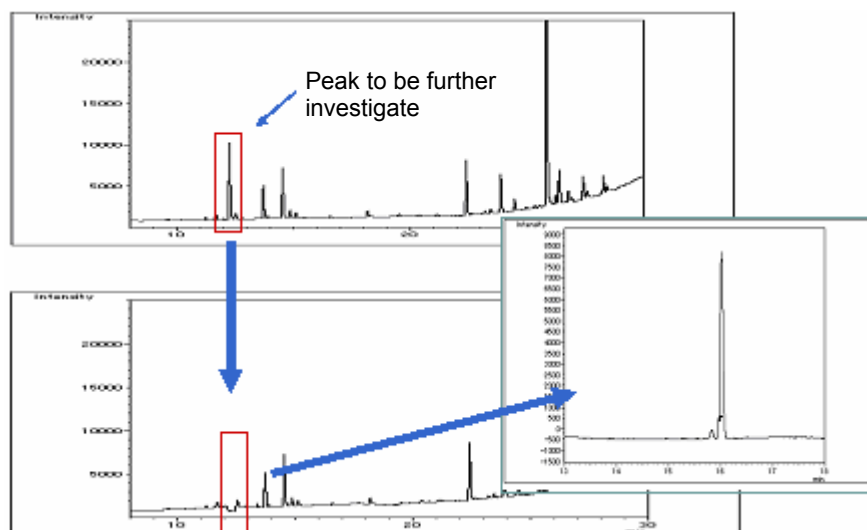
This manual has been prepared on the assumption that the user understands how to operate GCMSsolution and GCsolution.

1. What Is "MDGC?"

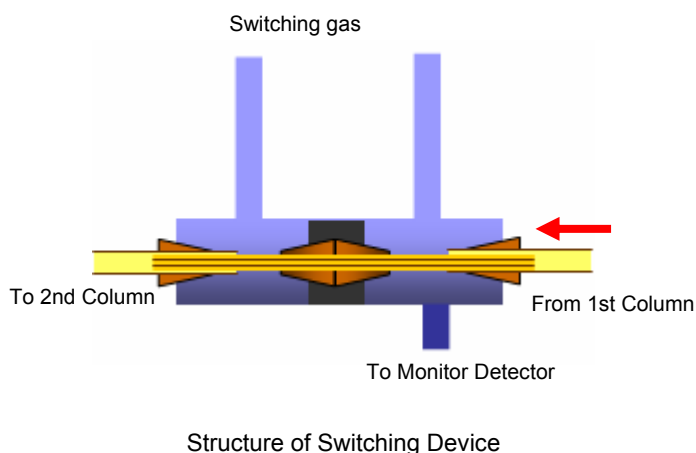
1.1 MDGC Method

In normal GC analysis, the sample is introduced into a column where it is separated and eluted, and the resulting components are detected by a detector. However, multi-dimensional GC is a technology for improving resolution beyond that of the regular GC analysis as it re-introduces the dissolved component into another column.

In other words, only part of the peak of the component that was insufficiently separated on the column where the sample initially passed through (called the "1st column") is introduced (heart-cut) to a column of another type (called the "2nd column") so that insufficiently separated components can be separated.



A device called a "switching device" is used for heart-cut introduction of peaks eluted from the 1st column to the 2nd column.



1.2 Switching Operation

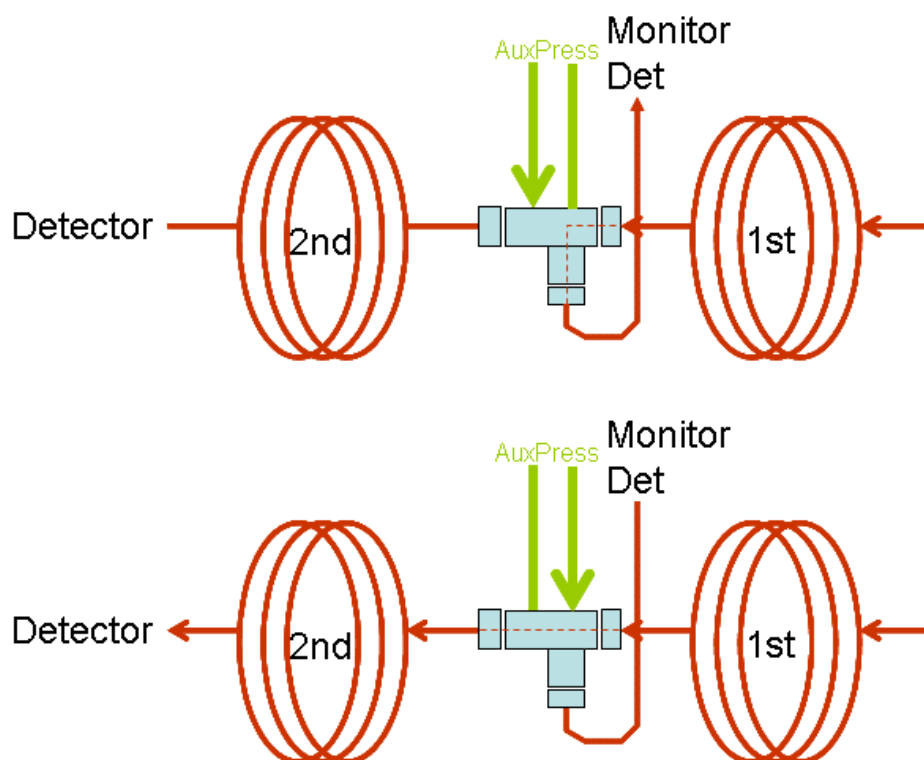
The following two modes are provided for selection of the carrier gas flow path by the switching device.

1.2.1 Standby Mode

In this mode, the sample passes through the switching device and reaches the detector of the 1st GC.

1.2.2 Cut Mode

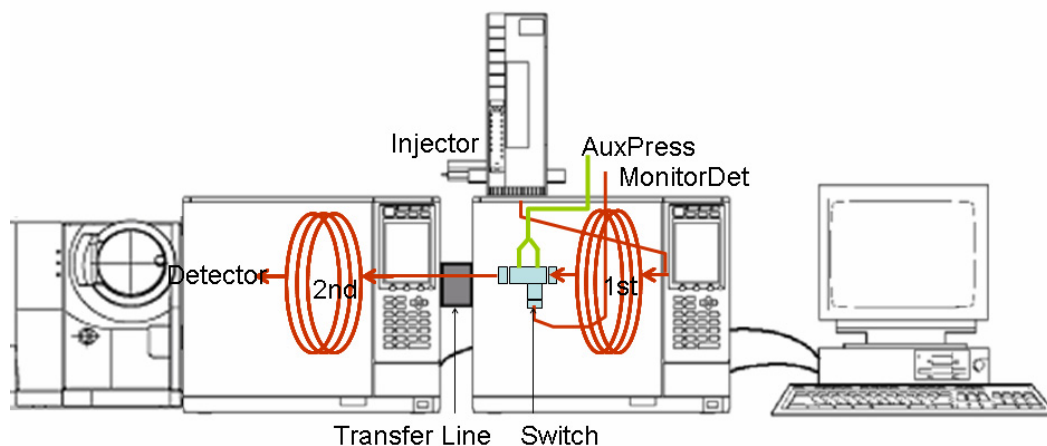
In this mode, the sample passes through the switching device, and is introduced to the 2nd column.



Operation of Switching Device (top: Standby mode, bottom: Cut mode)

1.3 Configuration of the MDGC System

The GC installed with the 1st column is called the "1st GC," and the GCMS or GC installed with the 2nd column is called the "2nd GCMS" or "2nd GC" (generically termed the "2nd instrument"). The 1st GC and 2nd GCMS/GC are connected by a transfer line (interface heater) whose temperature can be maintained.



1.3.1 Configuration of 1st GC

The 1st GC is equipped with a sample introduction instrument (e.g. injector), column, switching device for selecting the flow path, and a monitor detector.

1.3.2 Configuration of 2nd Instrument

The column inlet of the 2nd instrument is connected to the switching device of the 1st GC via the transfer line (interface heater).

The column outlet is connected to the detector of the 2nd GCMS/GC.

1.3.3 Sample Introduction Instrument

The AOC-20i, AOC-5000, TD-20 can be used as sample introduction instruments.

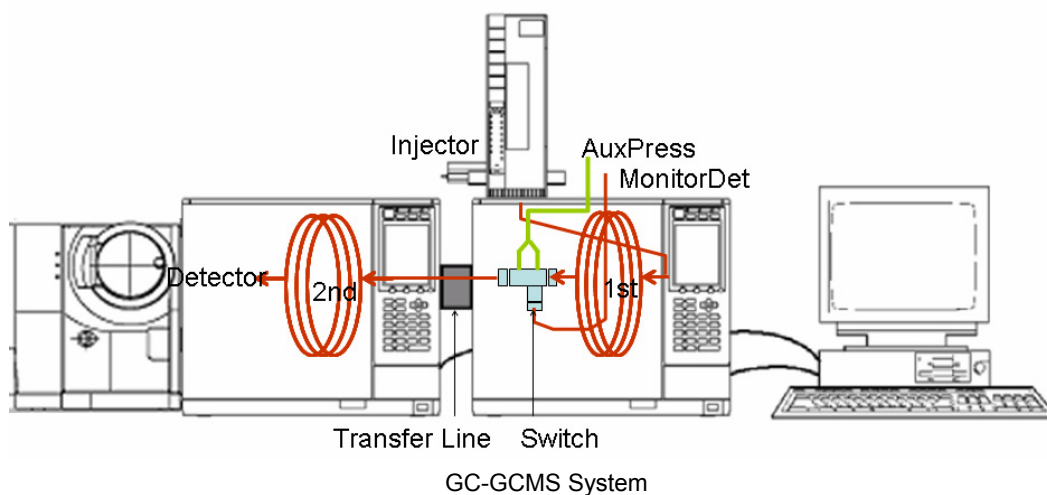


The AOC20s cannot be installed on the 1st GC.

1.4 Example of MDGC System Configuration

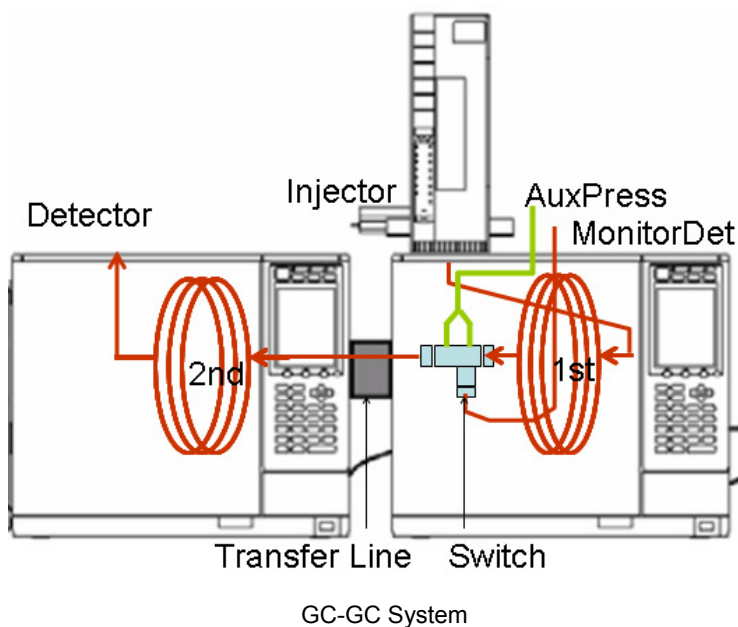
1.4.1 GC-GCMS System

The combination of a GCMS as the 2nd side is used for qualification of unknown components.



1.4.2 GC-GC System

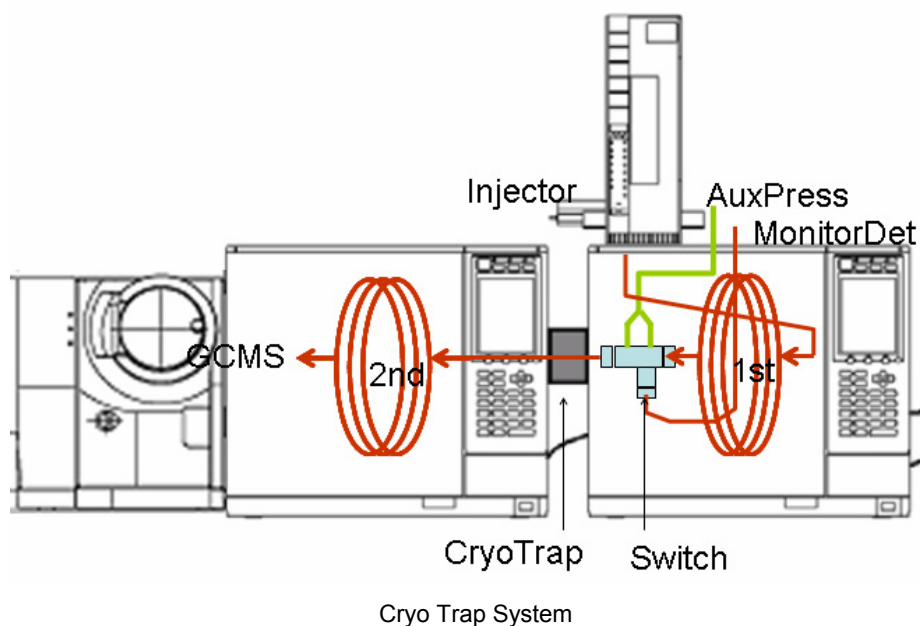
The combination where the 2nd side is also a GC is normally used for quantitation of already known components to be measured.



1.4.3 Cryo Trap System

In this system, a coolant cooling module is added on to the tip of the column inlet of the 2nd GCMS/GC. This makes it possible to make peaks of low boiling point components sharper, and to concentrate the peaks of components (heart-cut components) that have been eluted during multiple analysis on the 1st GC.

Normally, a GCMS is used as the detector for the purpose of improving sensitivity for qualification. MDGCsolution does not support coolant cooling in the 1st GC column oven.



2. Outline of MDGCsolution

2.1 What Is "MDGCsolution?"

The MDGCsolution workstation software has functions for controlling the temperature and acquiring the data of the 1st GC, for controlling the carrier gas of the 1st GC and 2nd GCMS/GC, and for setting data file names and analysis conditions for the 2nd GCMS/GC control software.

MDGCsolution allows you to execute Realtime Analysis (Single, Batch) by interlocking with GCMS/GC Realtime Analysis on the 2nd GCMS/GC to acquire data.

Acquired data files can be handled on the standard GCsolution and GCMSsolution since these applications share the same file format.



MDGCsolution data files can be handled only in Ver. 2.30SU7 or later in GCsolution, or Ver. 2.50Su4 or later in GCMSsolution.

2.2 Configuration of MDGCsolution

Install MDGCsolution on a PC pre-installed with GCsolution.

When MDGCsolution is installed, GCsolution's functions are expanded so that the system can be used as an MDGC.

Install MDGCsolution on PCs pre-installed with GCsolution and GCMSsolution when the 2nd side is a GCMS.

2.2.1 When the 2nd Instrument Is a GCMS

The configuration of the desktop icons changes as follows when the MDGC optional software is installed. With software other than MDGCsolution, functions are almost the same as those of the standard GCsolution or GCMSsolution.

 See 2.3.



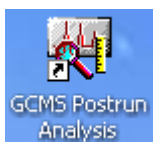
Starts up [MDGCsolution Launcher].

 See 2.2.3.



Opens GCMSsolution's [GCMS Analysis Editor] window.

 See 2.2.4.



Opens GCMSsolution's [GCMS Postrun Analysis] window.

 See 2.2.5.



Opens GCMSsolution's [GCMS Browser] window.

 See 2.2.6.



When the 2nd GCMS is used as a standalone GCMS and not an MDGC system, GCMSsolution's [GCMS Realtime Analysis] window opens.

 See 2.2.7.



When the GC is used as a standalone GC and not an MDGC system, the [GCsolution Launcher] opens.

 See 2.2.8.

2.2.2 When the 2nd Instrument Is a GC

The configuration of the desktop icons changes as follows when the MDGC optional software is installed. With software other than MDGCsolution, functions are almost the same as those of the standard GCsolution, excluding some additional or limited functions.



Starts up [MDGCsolution Launcher].

 See 2.2.3.



When the GC is used as a standalone GC and not an MDGC system, the [GCsolution Launcher] opens.

 See 2.2.8.

2.2.3 MDGCsolution

Starts up [MDGCsolution Launcher]. When [MDGCsolution Launcher] starts up, the Launcher has two menu items, [Operation] and [Administration]. The [Operation] menu is normally used, and is registered with the icons required for performing analysis on the MDGC system.

- **When the 2nd side is a GCMS**

Real Time Analysis, Offline Editor, GC Postrun, GCMS Postrun



- **When the 2nd side is a GC**

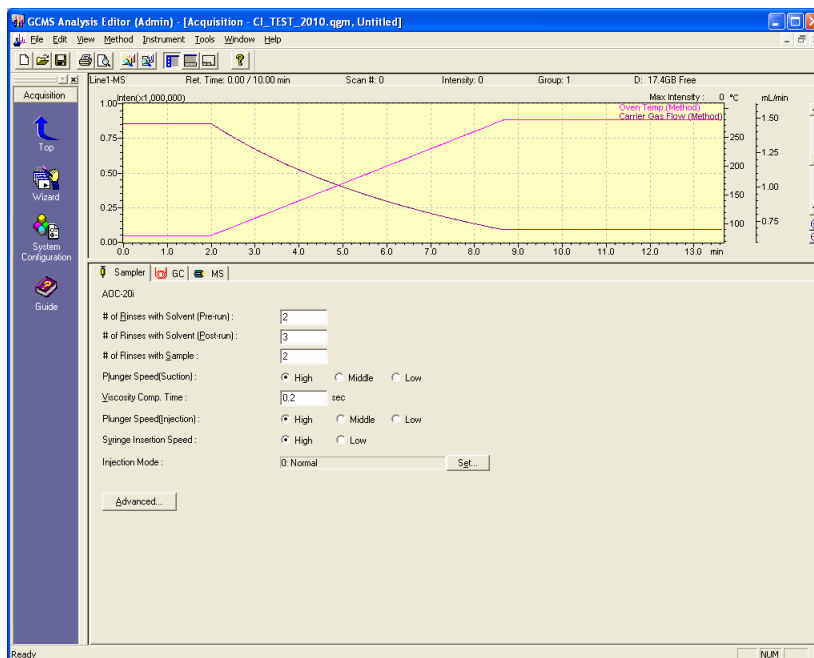
Real Time Analysis, Offline Editor, GC Postrun



2. Outline of MDGCsolution

2.2.4 GCMS Analysis Editor

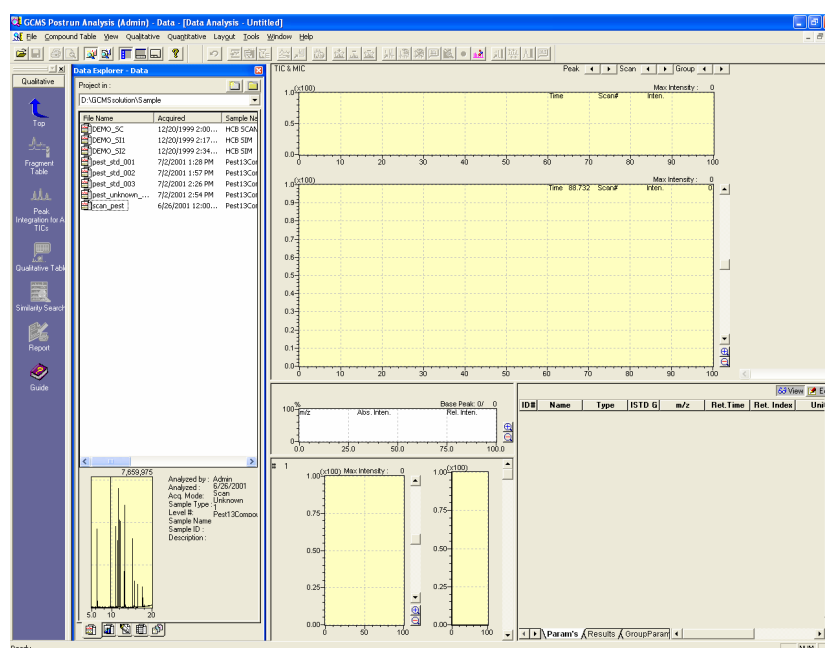
This window is for performing only editing of GCMS methods and batch files.



[GCMS Analysis Editor] Window

2.2.5 GCMS Postrun Analysis

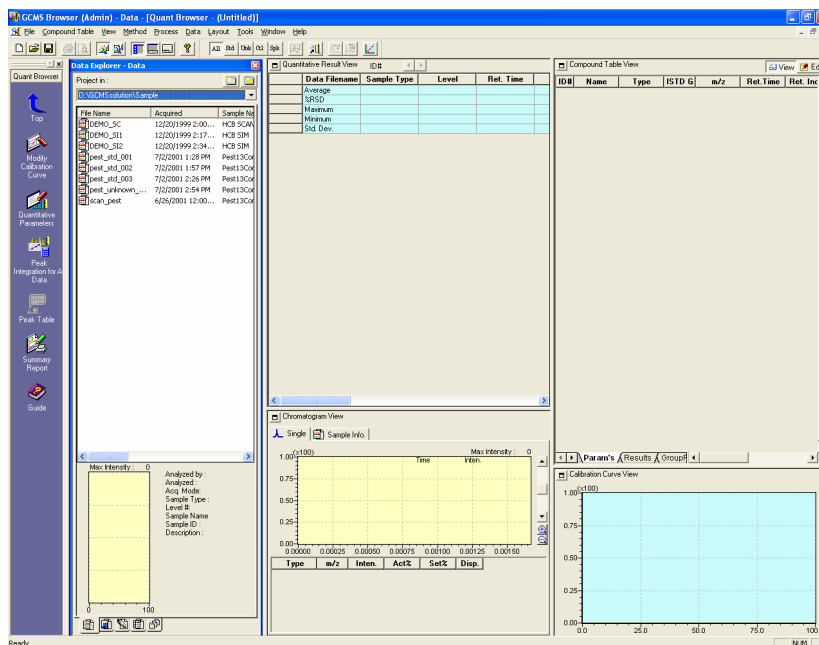
This window is for performing post-processing such as re-processing of GCMS data, checking calibration curves, and Batch Postrun.



[GCMS Postrun Analysis] Window

2.2.6 GCMS Browser

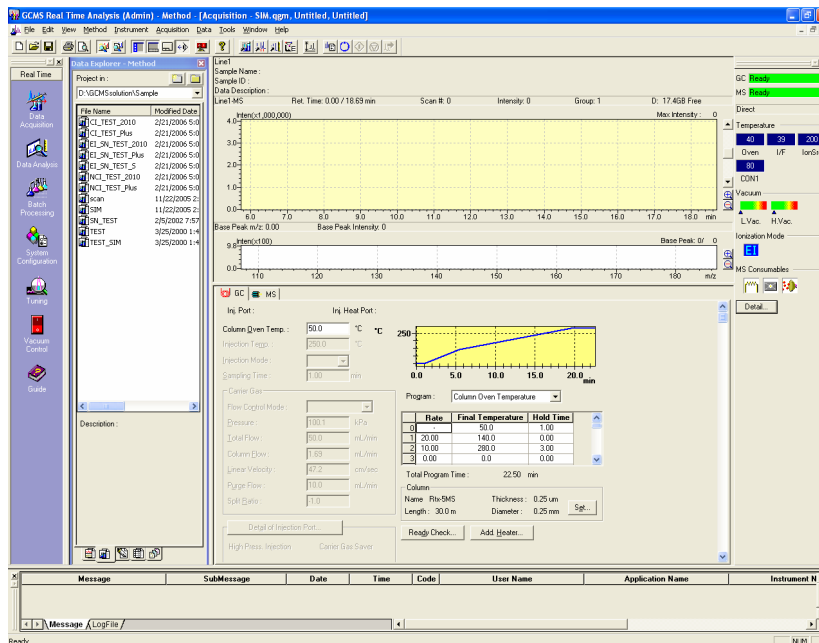
This window is for comparing GCMS data and performing statistical processing.



[GCMS Browser] Window

2.2.7 GCMS Real Time Analysis

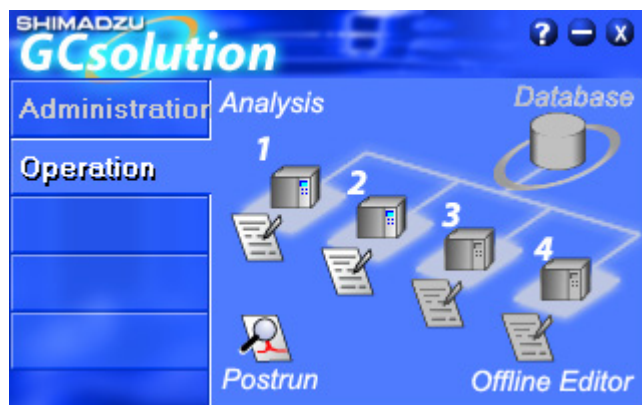
This window is the standard GCMSsolution [Real Time Analysis] window. This window starts up when the 2nd GCMS is used as a standalone GCMS and not as an MDGC system.



[GCMS Real Time Analysis] Window

2.2.8 GCsolution Launcher

This is the standard GCsolution launcher. This window starts up when the GC is used as a standalone GC and not as an MDGC system.



GCsolution Launcher

2.3 Additional Functions and Limited Functions Accompanying Installation of MDGCSolution

Compared with GCSolution, MDGCSolution has additional and limited functions. Also, some of the GCSolution and GCMSsolution functions on the 2nd side are added or limited when MDGCSolution is installed.

2.3.1 Functions Added on MDGCSolution

- Batch tables on the 2nd side can be edited on MDGCSolution.
MDGCSolution has functions for preparing batch tables on the 2nd side to control two GCs and GCMSs. These functions must be used to enter items required on the 2nd side.
- The [GC] and [MDGC] tabs have been added for setting MDGC parameters.
The [GC] tab page groups together settings relating to [INJ], [DET] and [Column] in the Advanced mode. The [MDGC] tab page groups together settings for displaying analysis conditions and setting the switching program.

2.3.2 Functions Limited on MDGCSolution

- Only the Fixed Pressure mode is supported as the carrier gas control mode.
When a method in the Constant Linear Velocity mode is loaded, change the mode to the Fixed Pressure mode to load it to MDGC.
- Coolant cooling is not possible inside the column oven.
MDGCSolution does not support the solenoid valve CRG for coolant cooling in the 1st GC column oven.
- A 2-line configuration cannot be made.
MDGCSolution only allows a single-line configuration (sample introduction module/detector pair) at all times.
- Agent Registration and Authentication Tool are not supported.
The [Database] icon is not displayed on the Launcher, and the User Administration, System Policy and Agent Registration of the standard GCSolution and GCMSsolution are used. These must each be set on the GC and GCMS.
- Bracket Quantitative cannot be used.
GCSolution-unique functions, Bracket Quantitative and Summary Report, cannot be used in [Batch Table Wizard]. These functions can be executed in Postrun.
- The action function is not available.
In batch processing, action function is not available so please do not use.

- The "Acquisition Start from Instrument" function cannot be used.
Since the "Acquisition Start from Instrument" function cannot be used on the MDGC system, the setting field in the [MDGC Real Time Analysis] window is hidden.
- The [Daily Shutdown] icon is displayed instead of the [System Off] icon on the assistant bar.

2.3.3 Functions Added and Limited in the 2nd Side [Real Time Analysis] Window

- Menus and buttons for closing the [Real Time Analysis] Window are hidden.
- The Real Time Analysis (Single, Batch) [Start], [Stop] and [Pause] menus and icons are hidden.
- The [Upload GC Parameters] menus and icons are hidden.
- GCMS-QP2010S is not supported.
Supported GCMSs are GCMS-QP2010 and GCMS-QP2010 PLUS. Also, only the GC-2010 is supported as the GC.
- [Daily Shutdown] menus and icons are hidden. (GCMSsolution only)





2.4 MDGCsolution Launcher

To start up [MDGCsolution Launcher], double-click the [MDGCsolution] icon, or click the Windows [Start] menu to open the menu, and click [MDGCsolution] under [Program]. [MDGCsolution Launcher] comprises two windows, [Operation] and [Administration]. Normally, the [Operation] window is used. However, the configuration of the icons in the [Operation] window differs when the 2nd side is a GC and when the 2nd side is a GCMS.

2.4.1 When the 2nd Side Is a GCMS






[Operation]

Real Time Analysis	Opens the [MDGC Real Time Analysis] window.	 See 2.6.
Offline Editor	Opens the [MDGC Real Time Analysis (Editor)] window.	 See 2.7.
GC Postrun	Opens the [GC Postrun] window.	 See 2.8.
GCMS Postrun	Opens the [GCMS Postrun Analysis] window.	 See 2.9.

2.4.2 When the 2nd Side Is a GC



[Operation]

Real Time Analysis	Opens the [MDGC Real Time Analysis] window.	 See 2.6.
Offline Editor	Opens the [MDGC Real Time Analysis (Editor)] window.	 See 2.7.
GC Postrun	Opens the [GC Postrun Analysis] window	 See 2.8.

2.5 Administration

[Administration] is the launcher for opening windows for setting functions mainly required by quality control departments, such as System Policy and User Administration.



The User Administration and System Policy of standard GCsolution and GCMSsolution are used. These must each be set on the GCsolution and GCMSsolution.

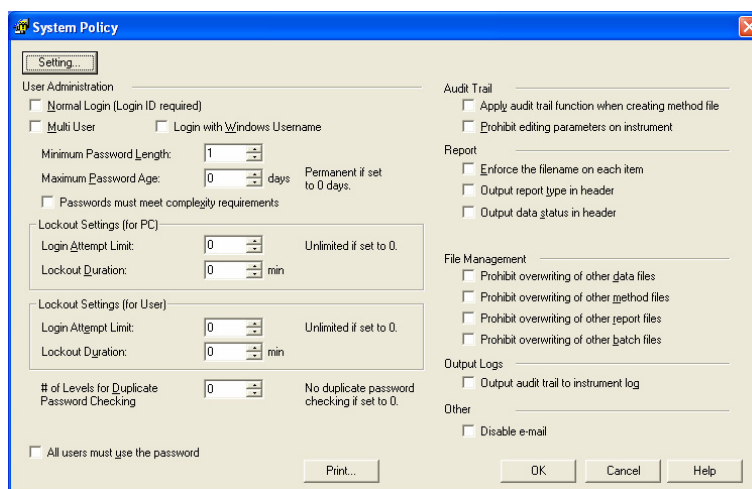


[Administration]

System Policy	Opens the [System Policy] window.	See 2.5.1.
User Administration	Opens the [User Administration] window.	See 2.5.2.
Log Browser	Opens the [Log Browser] window.	See 2.5.3.

2.5.1 System Policy

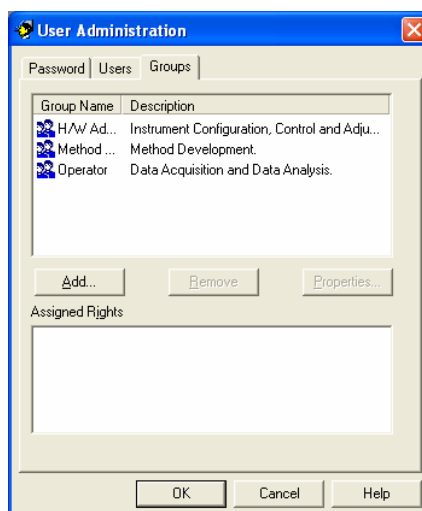
When using System Administration functions, set System Administration conventions (i.e. policy), such as login method and password limitations.



[System Policy] Window

2.5.2 User Administration

You can register users or periodically change passwords.
You can also set rights groups with preset operation rights.

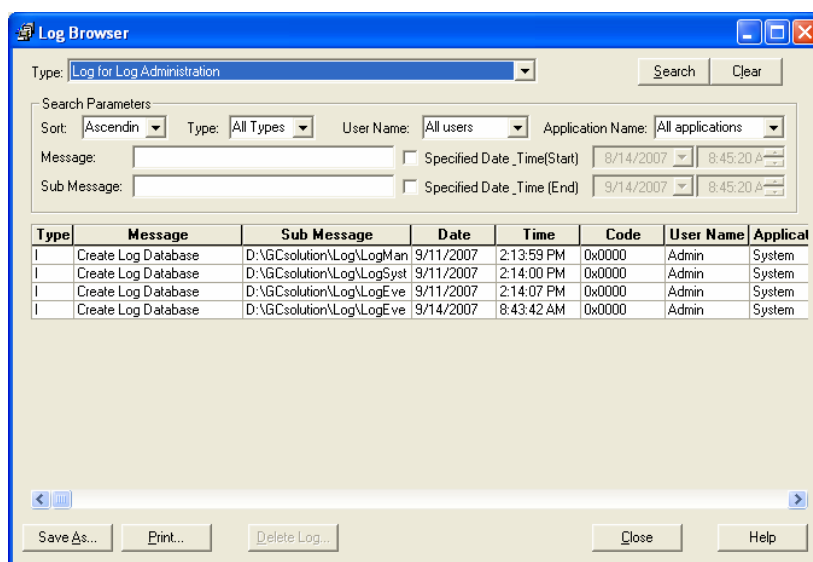


[User Administration] Window

2.5.3 Log Browser

The [Log Browser] window allows you to filter logs such as operation histories and display these as a list.

This window displays event logs relating to log administration, system administration and analytical instruments.



[Log Browser] Window

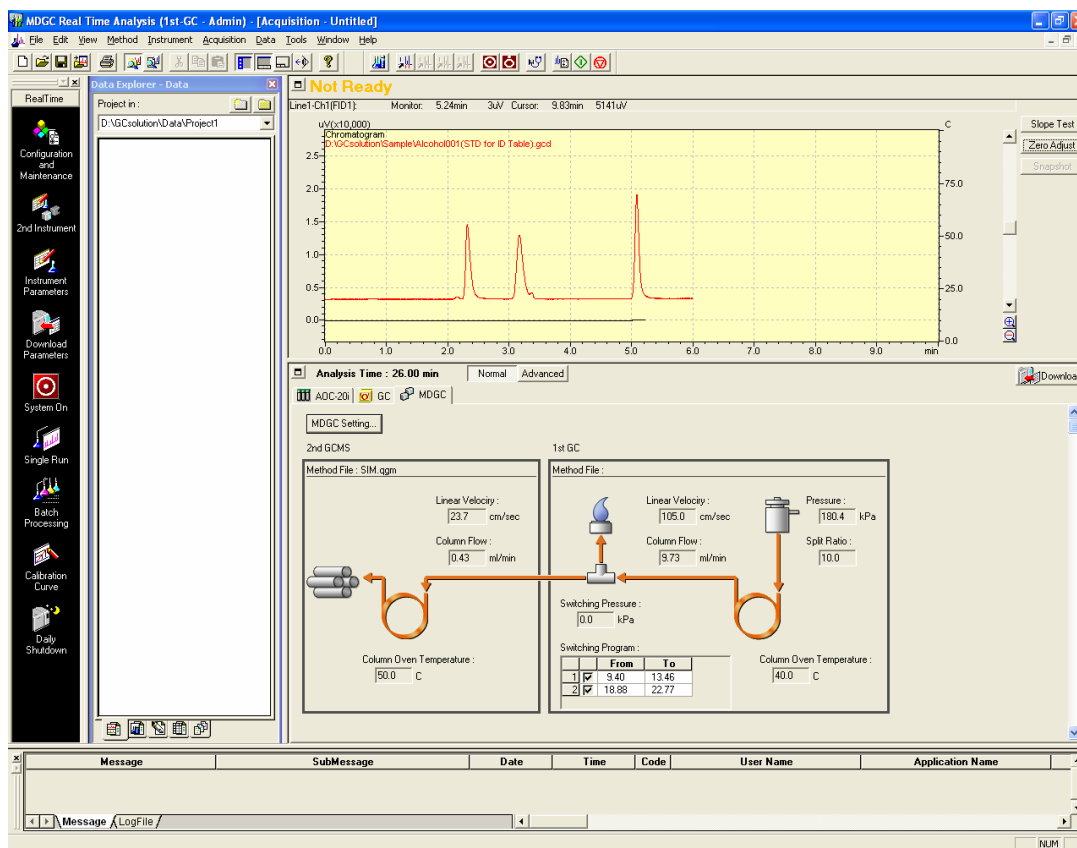
For details on programs that are registered to [Administration], refer to GCsolution Administration Manual.

When the 2nd instrument is a GCMS, refer to the GCMSsolution Instruction Manual.

2.6 MDGC Real Time Analysis

To open the [MDGC Real Time Analysis] window, click the [Real Time Analysis] icon in [MDGCsolution Launcher].

The [MDGC Real Time Analysis] window is for controlling the 1st GC of the MDGC system. In this window, you set the carrier gas pressure, flow rate and other processing conditions, set the temperature of various components such as the column oven temperature program of the 1st GC, and set and execute Single Run and Batch Analysis.

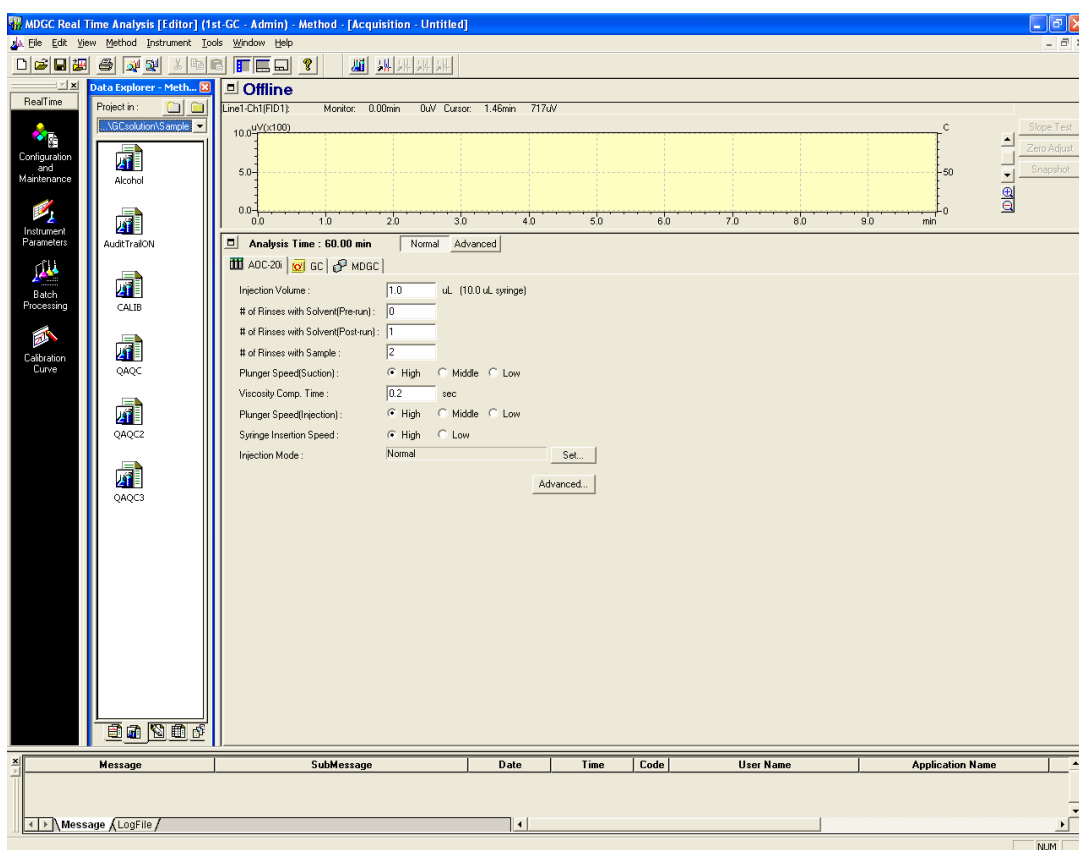


[MDGC Real Time Analysis] Window

2.7 MDGC Real Time Analysis (Editor)

To open the [MDGC Real Time Analysis (Editor)] window, click the [Offline Editor] icon in [MDGCsolution Launcher].

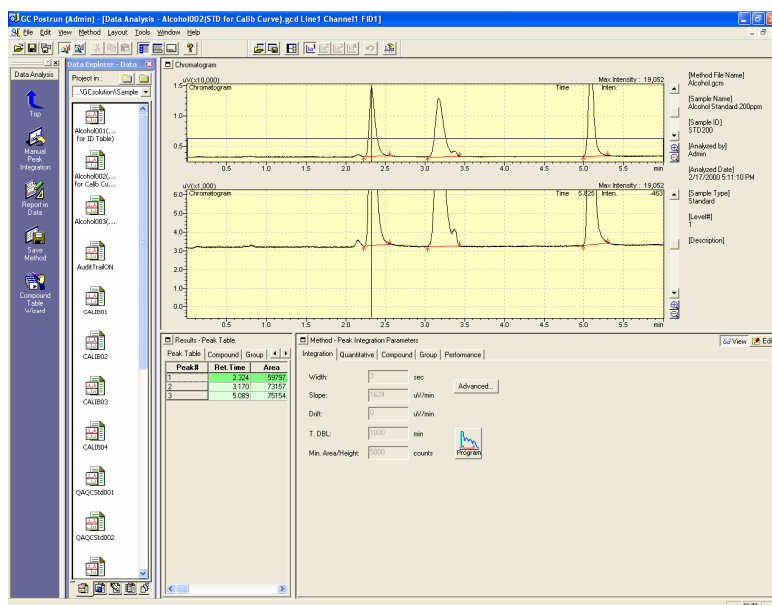
This window differs with the [Real Time Analysis] window in that files can only be edited. Use this window to edit methods or batch files while MDGC Real Time Analysis is running.



[MDGC Real Time Analysis (Editor)] Window

2.8 GC Postrun

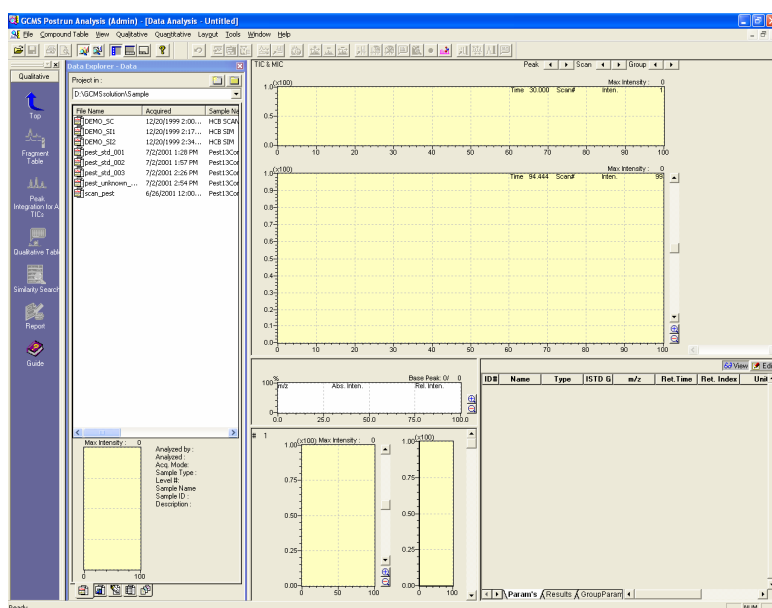
This window is for performing post-processing such as re-processing of GC data, checking of calibration curves, and Batch Postrun.



[GC Postrun] Window

2.9 GCMS Postrun Analysis

This window is for performing post-processing such as re-processing of GCMS data, checking of calibration curves, and Batch Postrun.



[GCMS Postrun Analysis] Window

3. Setting Use of the MDGC System

The system must be configured to use the MDGC system.

3.1 Login Setting

GCsolution or GCMSsolution on the 2nd side can be started up from MDGCsolution by matching the user ID and password of the GCsolution or GCMSsolution on the 2nd side with those of MDGCsolution.

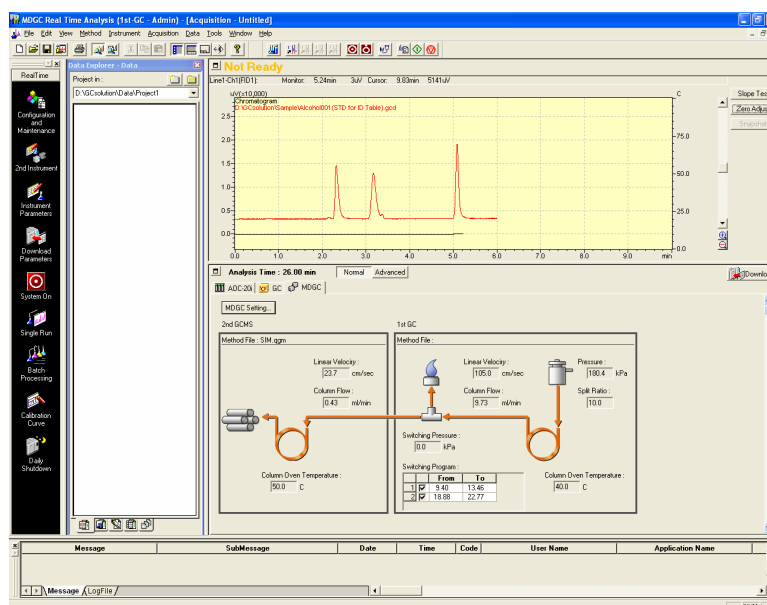
3.1.1 Checking Login Operation

1. To open the [Login] window, click the [Real Time Analysis] icon.



[Login] Window

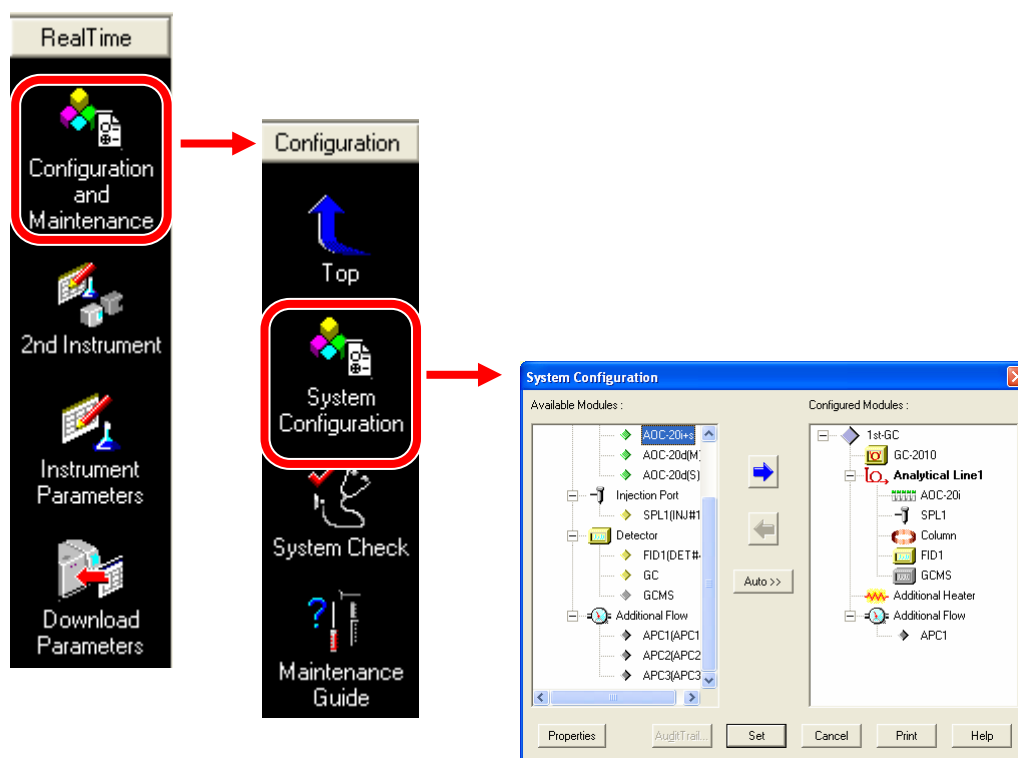
2. The default user ID and password are "Admin" and no password.
3. Click [OK] in the [Login] window to open the [MDGC Real Time Analysis] window.



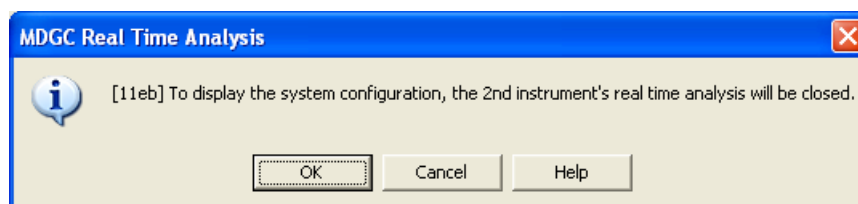
[MDGC Real Time Analysis] Window

3.2 System Configuration

The settings for using an MDGC system must be made at System Configuration in the [MDGC Real Time Analysis] window. To open the [System Configuration] window, click the [System Configuration] icon on the assistant bar.

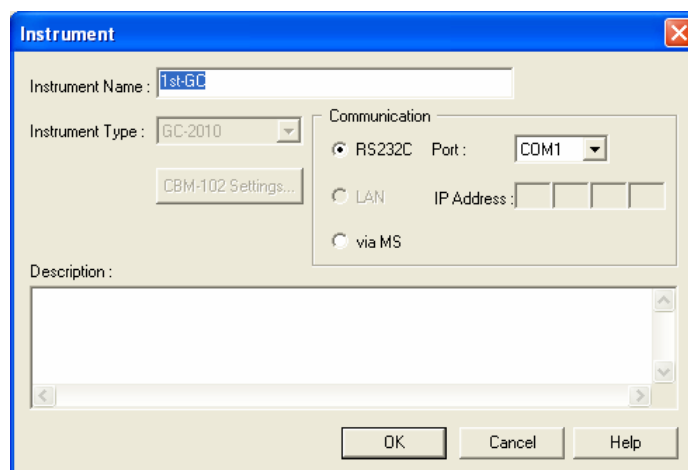
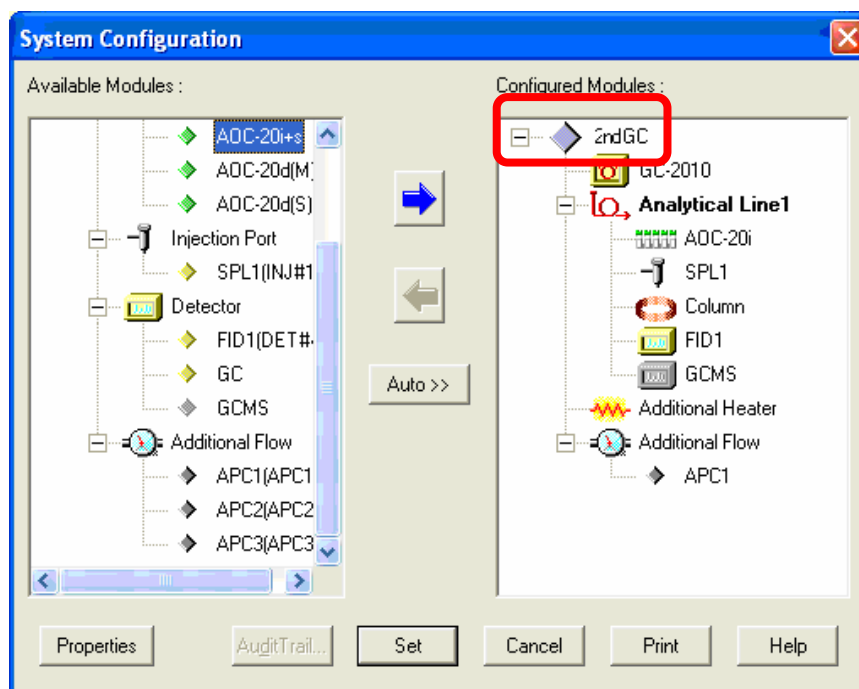


If the 2nd GCMS/GCsolution is already open when the [System Configuration] icon is clicked, the following dialog box is displayed. Click [OK] to close this dialog box.



3.2.1 Setting the Communication Port and Instrument Type

Double-click [2nd-GC] in the [System Configuration] window to display the [Instrument] window. In this window, select the instrument name and communication port.



[Instrument] Window



Instruments other than the GC-2010 cannot be selected since MDGCsolution supports only the GC-2010.

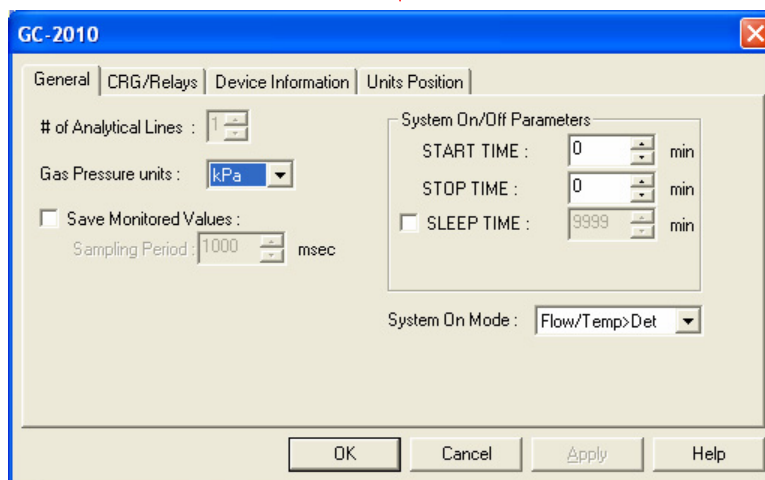
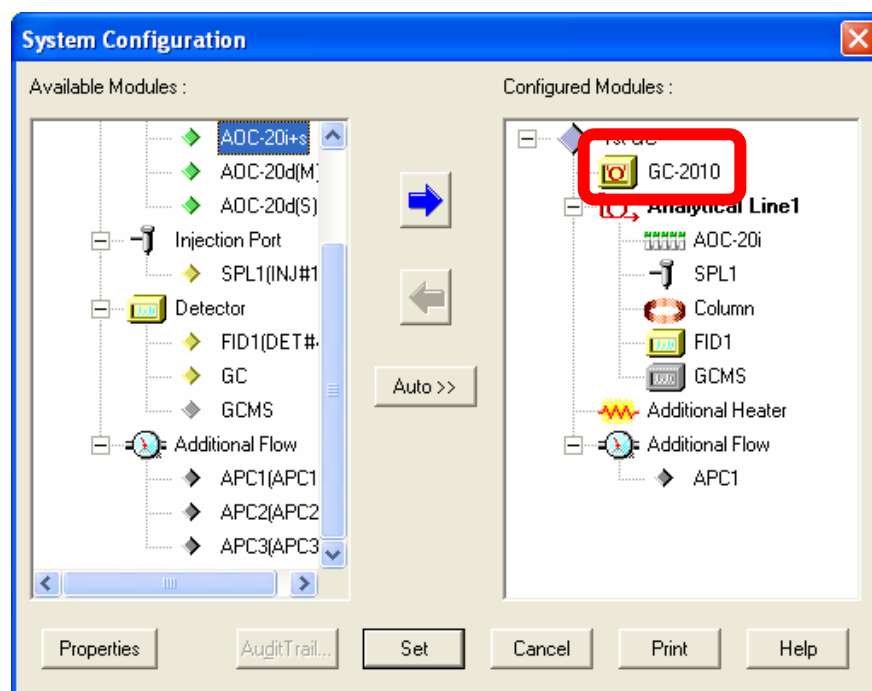


Name of the instrument is Instrument2 default, but it is possible to change the name.

3. Setting Use of the MDGC System

3.2.2 Setting GC-2010 Properties

Double-click the [GC-2010] icon in the [System Configuration] window to open the [GC-2010] properties window.



[GC-2010] Properties Window



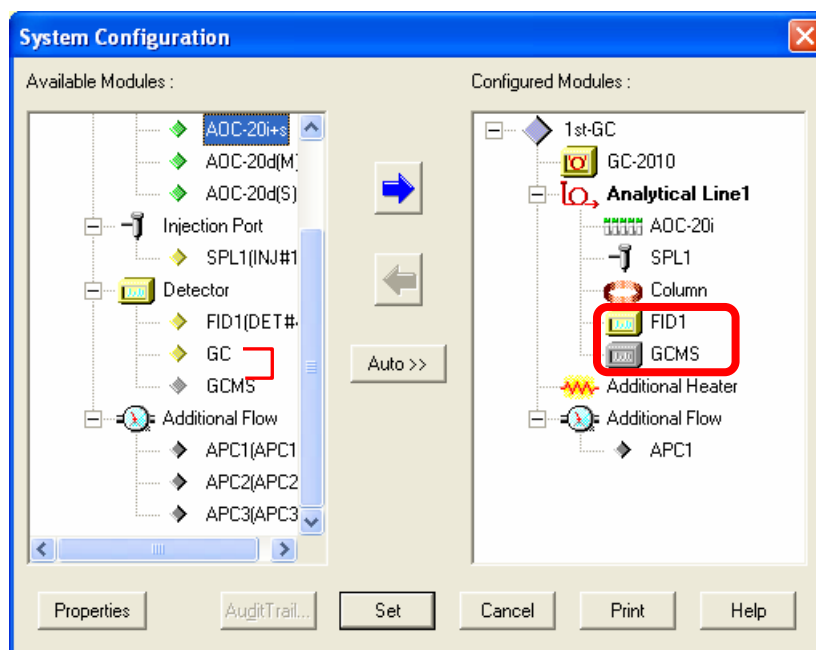
In MDGCsolution, only "1" can be set at [# of Analytical Lines]. Other numbers cannot be set.



In MDGCsolution, [CRG/Relays] cannot be selected since this item is not available.

3.2.3 Selecting the 2nd GCMS or GC

Set whether to open the [GCMS Real Time Analysis] window or the [GC Real Time Analysis] window on the 2nd side. When the 2nd side is a GCMS, add GCMS to [Configured Modules], and when the 2nd side is a GC, add GC.



[System Configuration] Window (selection of GC or GCMS as 2nd side)

3.2.4 GCMS (or GC) Properties

When a cryo trap is used at the 2nd side column inlet, select the [Cryo Trap] checkbox. The [Cryo Trap] program editing window is displayed in the MDGC Method editing window. Also, when an APC is installed at the 2nd column outlet for branching the column outlet, select the [2nd column outlet press] checkbox.

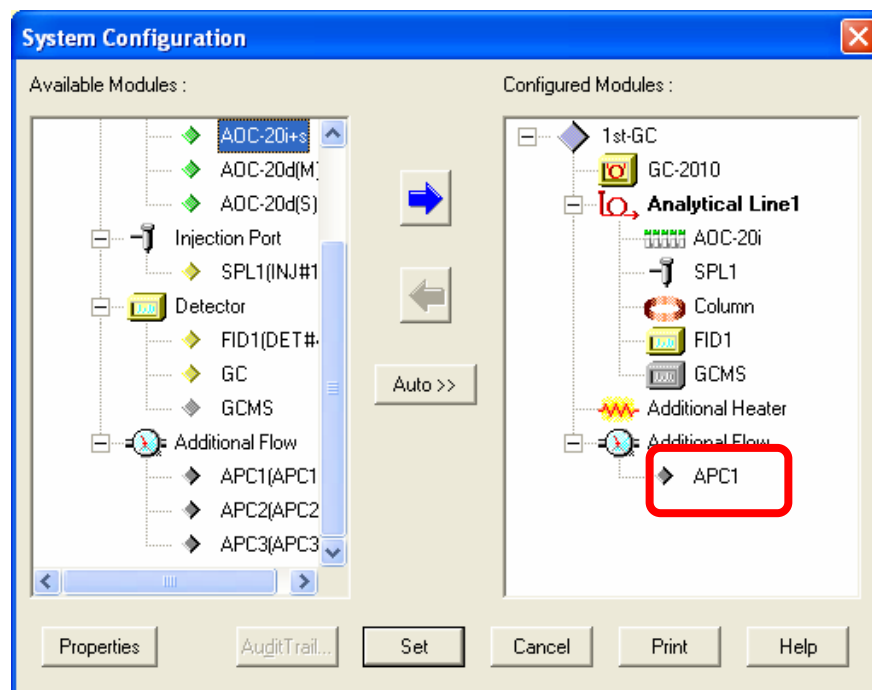


[Modules of Analytical Line#1] Window

3. Setting Use of the MDGC System

3.2.5 Selecting the APC for Switching

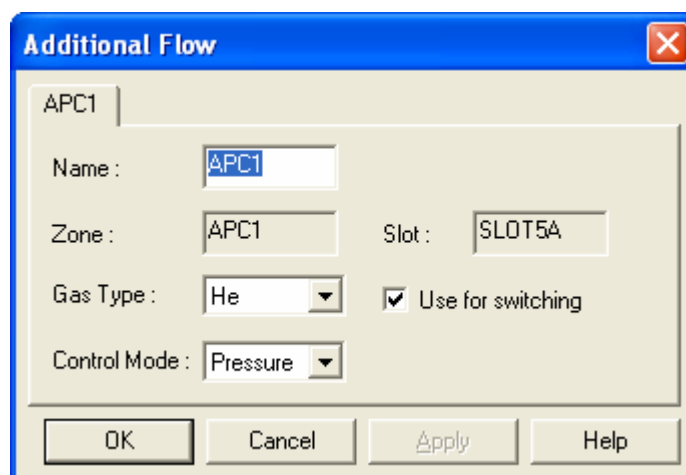
Select the APC to be used for the switching device.



[System Configuration] Window (selection of APC for switching)

3.2.6 Setting Additional Flow

When the [Use for the Switching] checkbox is selected, this APC is used for switching the MDGC.

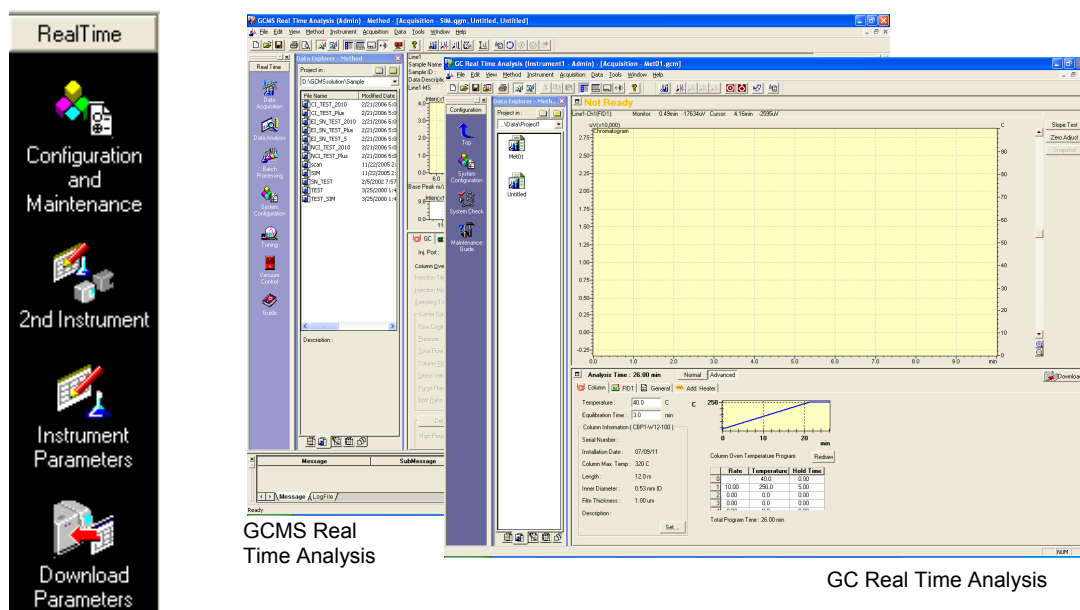


[Additional Flow] Window

3.2.7 System Configuration of 2nd Instrument

The [GC Real Time Analysis] or [GCMS Real Time Analysis] window must be started to configure the 2nd instrument.

Clicking the [2nd Instrument] icon on the assistant bar in the [MDGC Real Time Analysis] window opens the [GC Real Time Analysis] window when the 2nd side is set as the GC in System Configuration or opens the [GCMS Real Time Analysis] window when the 2nd side is set as the GCMS.

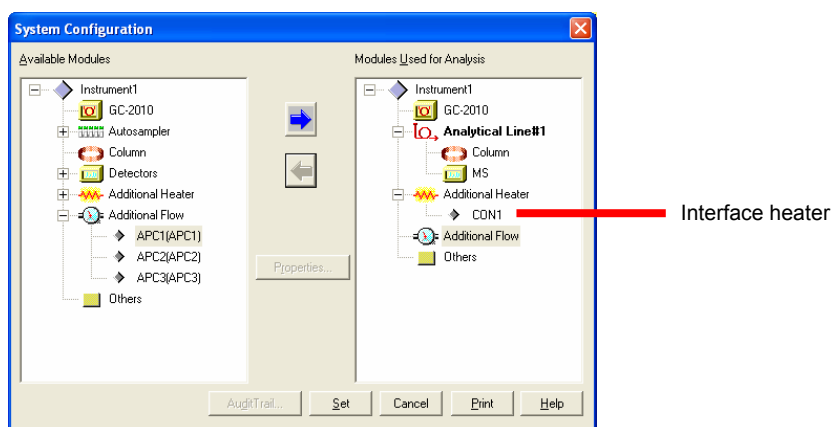


Starting Up the 2nd Instrument

2nd GCMS/GC performs the role of controlling the heating module (interface heater) between the 1st GC and 2nd GCMS/GC. For this reason, the additional heater must be registered under [Configured Modules] in System Configuration.

3.2.8 When the 2nd Side Is a GCMS

Register the column, MS and additional heater under [Configured Modules].



2nd GCMS [System Configuration] Window

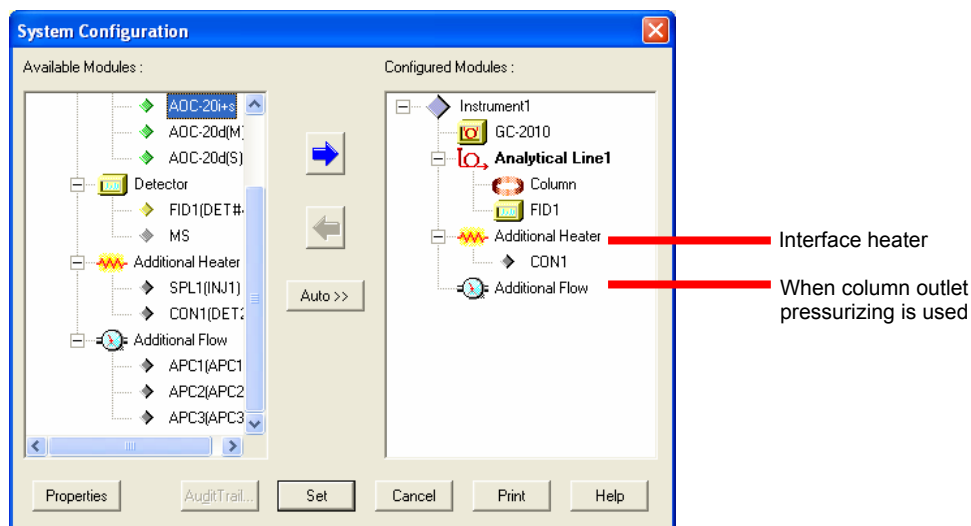


Name of the instrument is Instrument1 default, but it is possible to change the name.

3. Setting Use of the MDGC System

3.2.9 When the 2nd Side Is a GC

Register the column, detector and additional heater under [Configured Modules].

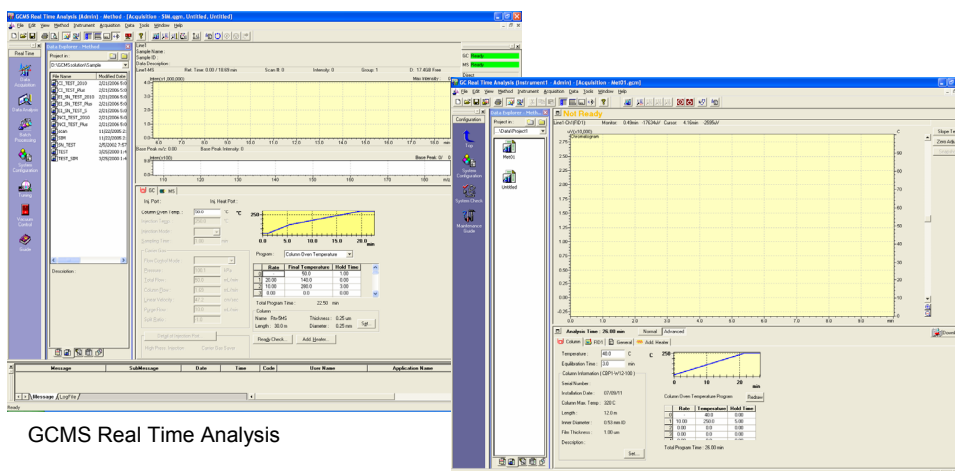


2nd GC [System Configuration] Window

3.2.10 Checking Startup of the 2nd Instrument

Clicking the [2nd Instrument] icon on the assistant bar in the [MDGC Real Time Analysis] window opens the 2nd side [GCMS Real Time Analysis] (or [GC Real Time Analysis]) window. When this window opens, the 2nd side is automatically logged in using the information (defaults: user name "Admin" and no password) of the user logged into the 1st side.

Also, clicking the [2nd Instrument] icon when the 2nd side [Real Time Analysis] window is open displays the 2nd side [Real Time Analysis] window at the front of the screen. When the [MDGC Real Time Analysis], [GCMS Real Time Analysis] or [GC Real Time Analysis] window opens, the method file that was used at the previous system shutdown is loaded.



GCMS Real Time Analysis

GC Real Time Analysis

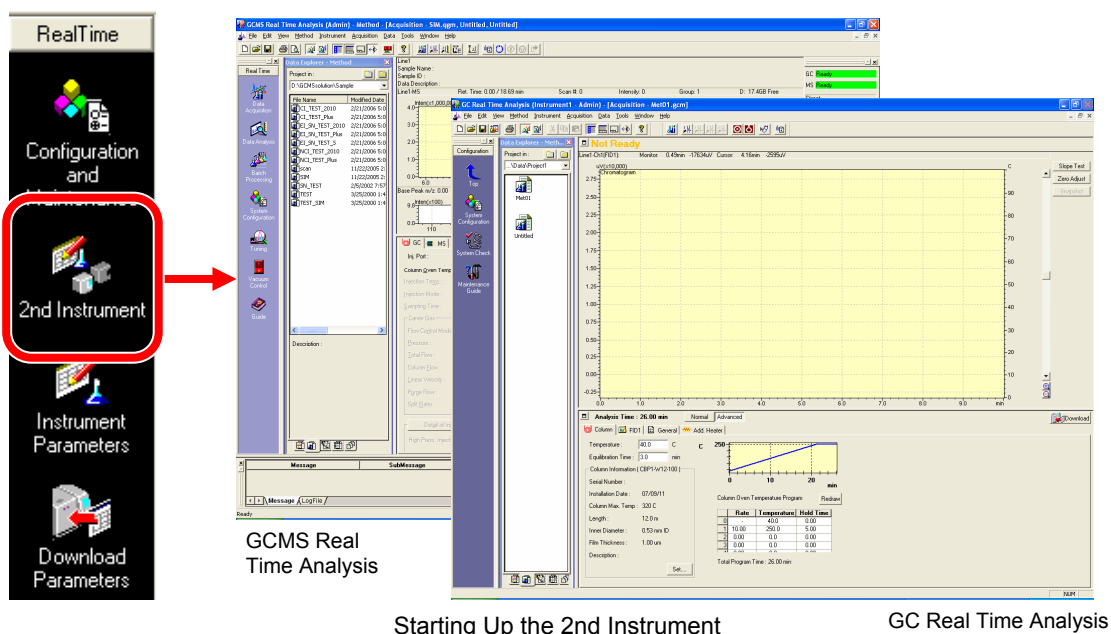
Starting Up the 2nd GCMS/GCsolution

3.3 Starting Up and Exiting the System

When the 2nd instrument is a GC, it can be started up from MDGCsolution just like the 1st GC. On the other hand, when the 2nd instrument is a GCMS, the [Vacuum Control] icon on the assistant bar of the [GCMS Real Time Analysis] window must be clicked to execute either of [Auto Startup] or [Manual Startup] to set the MS to a vacuum state.

3.3.1 Starting Up the 2nd Instrument Window

Clicking the [2nd Instrument] icon on the assistant bar in the [MDGC Real Time Analysis] window opens the [GC Real Time Analysis] window when the 2nd side is set as the GC in System Configuration and the [GCMS Real Time Analysis] window when the 2nd side is set as the GCMS.

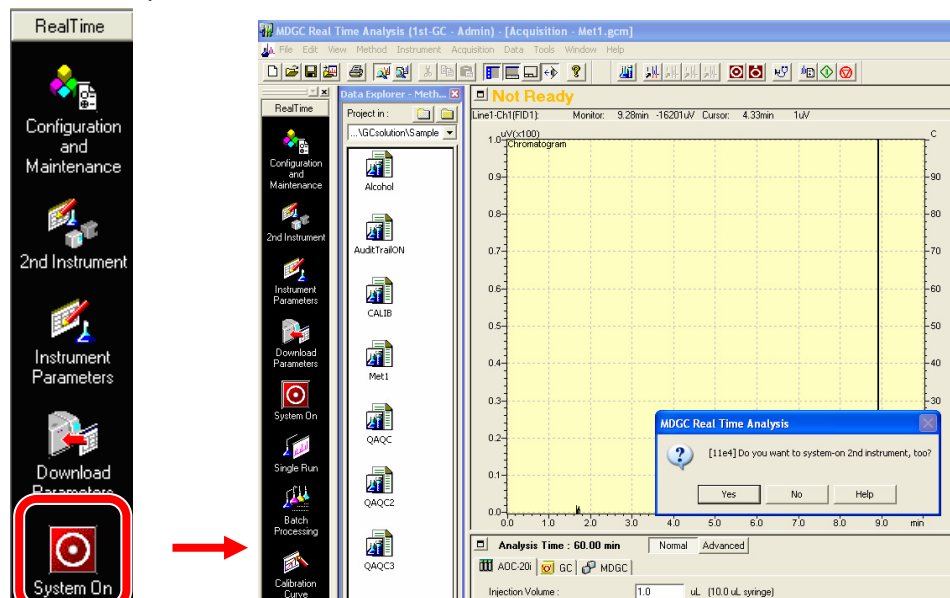


Be sure to start up the 2nd side [GCMS/GC Real Time Analysis] window from the assistant bar. The 2nd side [GCMS/GC Real Time Analysis] window does not run interlocked with MDGCsolution when it is started up from the Desktop icon or the Windows [Start] menu.

3. Setting Use of the MDGC System

3.3.2 Starting Up GC (when the 2nd Side is a GC)

Clicking the [System On] icon on the assistant bar in the [MDGC Real Time Analysis] window starts up the 1st GC instrument.



2nd Instrument Startup Confirmation Dialog Box

The "Do you want to system-on 2nd instrument, too?" message is displayed. Clicking [Yes] starts up both the 1st GC instrument and 2nd instrument. When the 2nd instrument is already started up, this message is not displayed, and only the 1st GC starts up. On the other hand, System OFF is performed individually on each of the 1st GC and 2nd instrument. (The 1st GC and 2nd instrument are not turned off in an interlocked manner.)

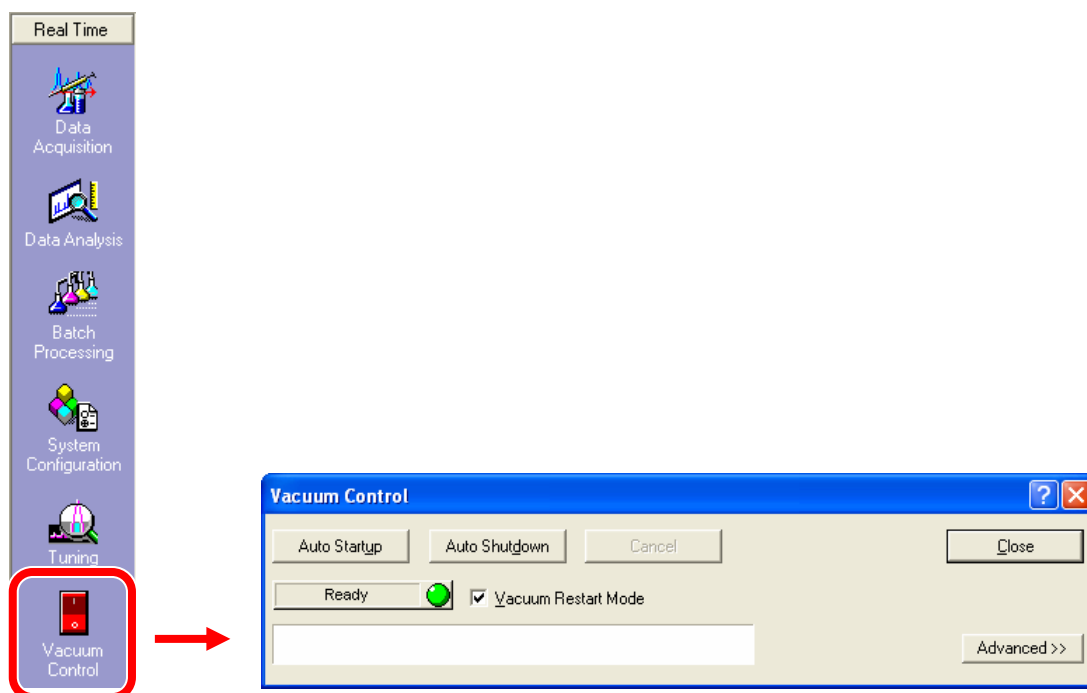



Clicking the [System On] icon when the 2nd side [GCMS/GC Real Time Analysis] window is not open, only the 1st GC starts up. If click Start icon "The 2nd real time analysis window is not started." error message being displayed. Before clicking the [System On] icon, click the [2nd Instrument] icon to open the 2nd side [Real Time Analysis] window.


3.3.3 Starting Up GC (when the 2nd Side is a GCMS)


Clicking the [Vacuum Control] icon on the assistant bar of the [GCMS Real Time Analysis] window to display the [Vacuum Control] window. After this, click the [Auto Startup] button. After several minutes, the indicator changes to "Ready".

Next, click the [System On] icon on the assistant bar in the [MDGC Real Time Analysis] window starts up the 1st GC. Also, the "Do you want to system-on 2nd instrument, too?" message is displayed. Clicking [Yes] turns the GC system on the GCMS side on.



 When GCMS is not ready, clicking the Start icon "The 2nd real time analysis window is not started." error message being displayed.

 Though it takes several minutes for the GCMS to reach a sufficient degree of vacuum and "Ready" to be displayed, several hours to one full day are required until analysis can be performed in a stable manner. This stabilization period depends on the measurement target.

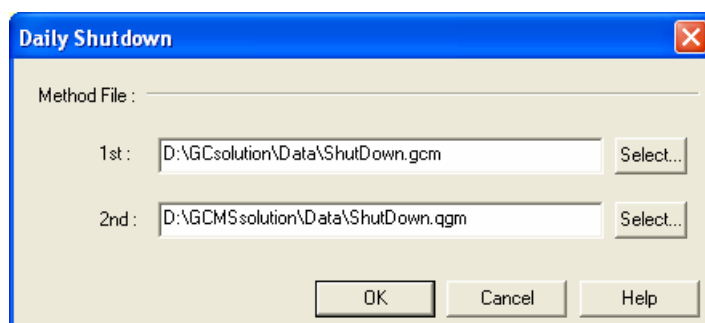
 For details on how to use GCMSsolution, refer to the GCMSsolution Instruction Manual.

3.3.4 Daily Shutdown

The Daily Shutdown function is provided to keep gas consumption to a minimum when analysis is not being performed.

When the 2nd instrument is a GCMS, this function can be used even with the vacuum in operation.

Prepare methods (shutdown method files) preset with lower carrier gas flow rates and column detector temperatures. Next, click the [Daily Shutdown] icon on the assistant bar to open the [Daily Shutdown] window. Select the 1st and 2nd side shutdown method files and click [OK]. This downloads the selected method files to the instruments.



The detector flame can be extinguished by stopping the gas of the GC detector (e.g. FID).



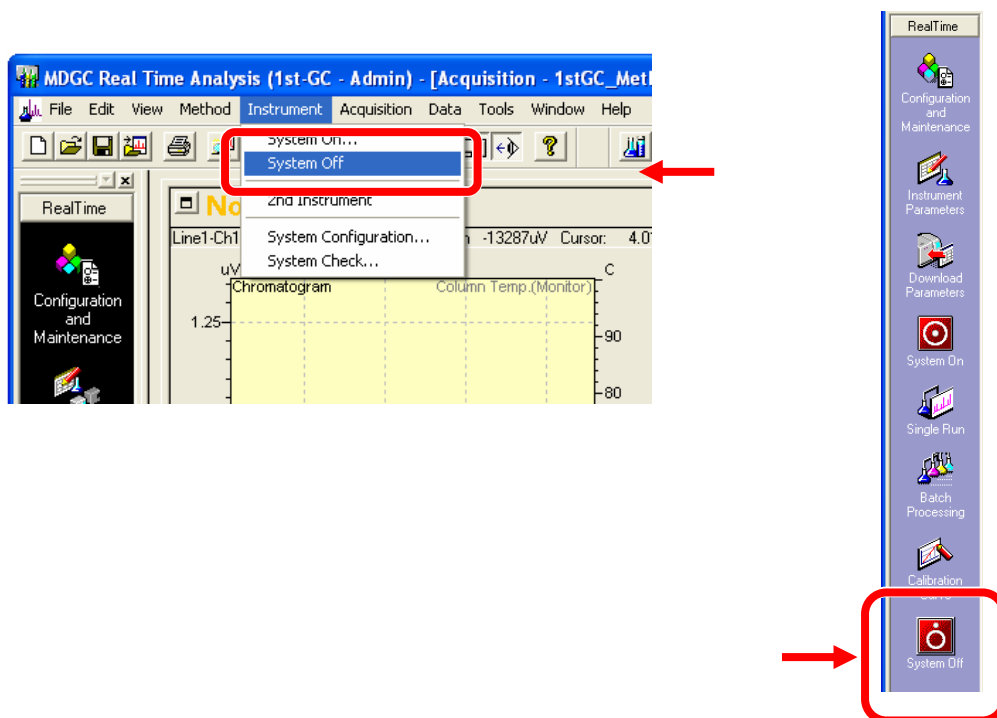
When the 2nd instrument is a GC, it is possible to turn off GC after using Daily Shutdown function to down the column temperature. But when the 2nd instrument is a GCMS, stop vacuum pumps with GCMSsolution before turn off the power.

3.3.5 Shutdown GC (when the 2nd Side is a GC)

To shut down GC (System OFF) should be done by each Instruments 1stGC / 2nd unit (Interlocking did not).

Clicking the <MDGC analysis> window [Instrument] - [System off], 1st GC stops.

Subsequently, Clicking the <GC analysis> assistant bar [stop] ,2nd unit stops.



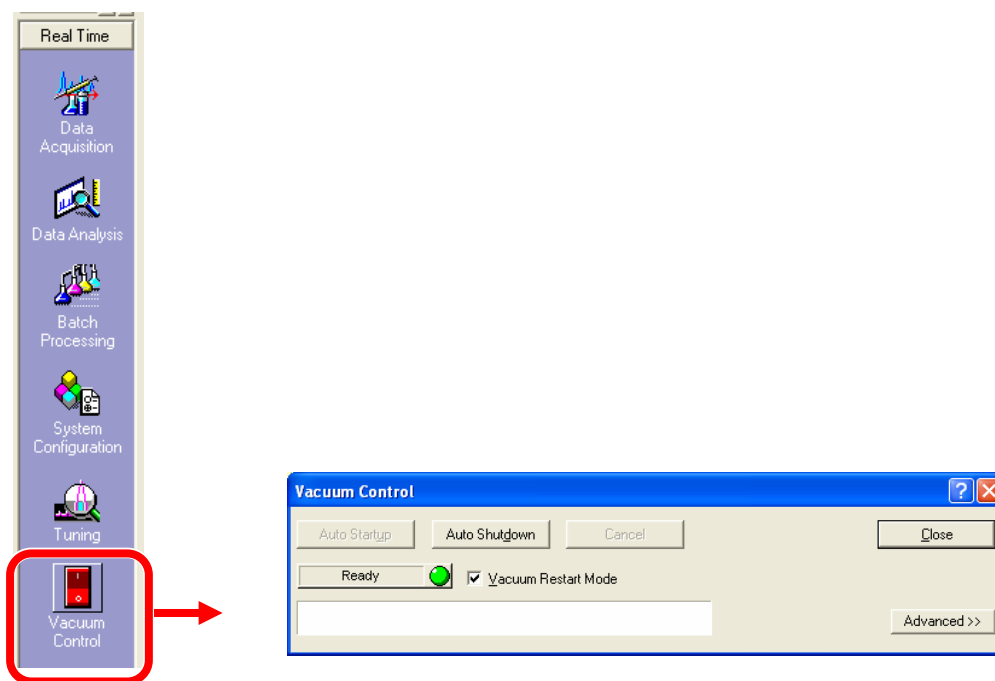
If shut down the GC system, carrier gas flow is not stop. Off the power after column temperature goes down, and close <MDGC analysis> window.

3. Setting Use of the MDGC System

3.3.6 Shutdown GC (when the 2nd Side is a GCMS)

To shut down GC (System OFF) should be done by each Instruments 1stGC / 2nd unit (Interlocking did not).

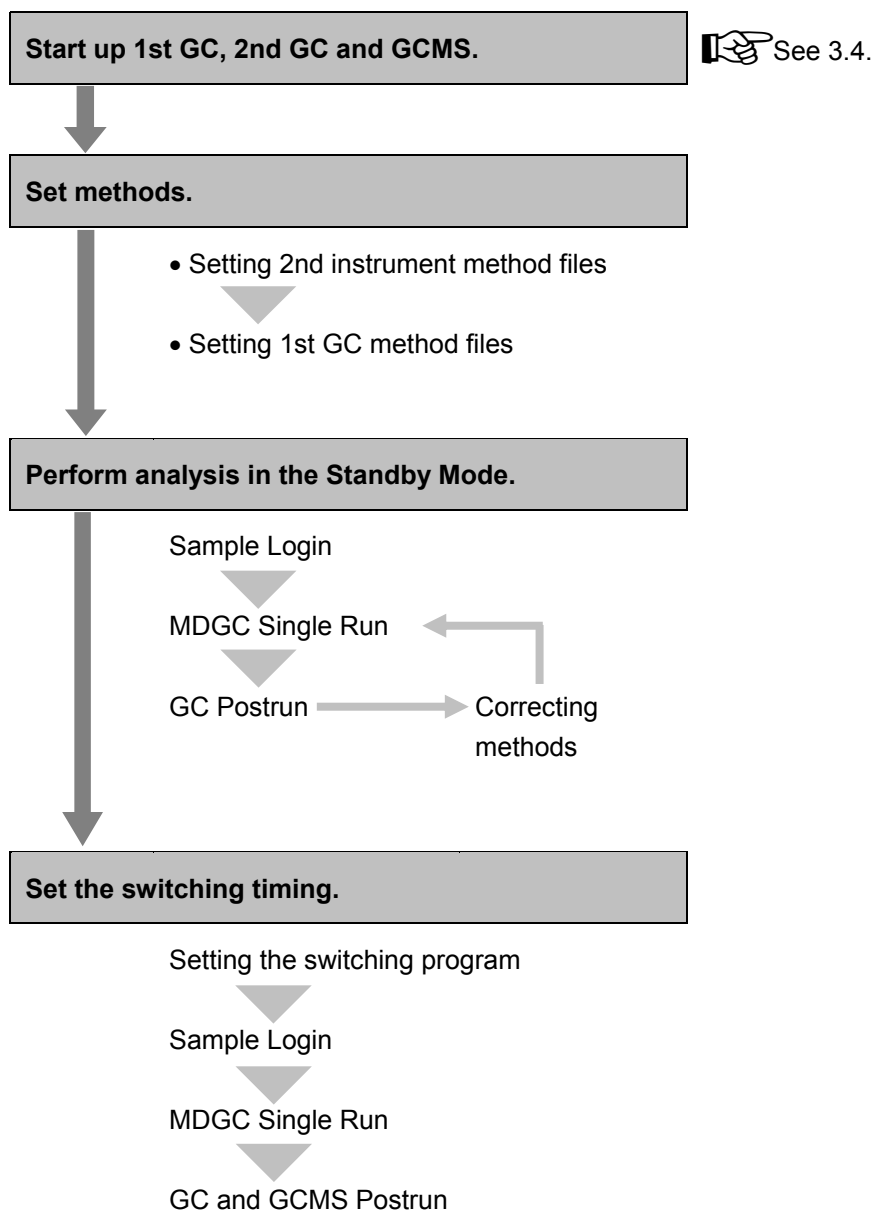
Clicking the <GCMS analysis> window [Vacuum Control] and then click [Auto Shutdown].After Indicator is complete, click the close button. Following click,<MDGC analysis> window [Instrument]-[System off] ,1st GC unit stops.



If shut down the GC system,carrier gas flow is not stop. Off the power after column temperature goes down,and close <MDGC analysis> window.

4. Performing MDGC Real Time Analysis

Analysis using MDGCsolution is performed according to the following procedure.



4.1 Setting 2nd Instrument Method Files

When the 2nd instrument is a GC, GCsolution data is acquired, and when the 2nd instrument is a GCMS, 2nd instrument data is acquired.

4.1.1 Starting Up the 2nd Instrument

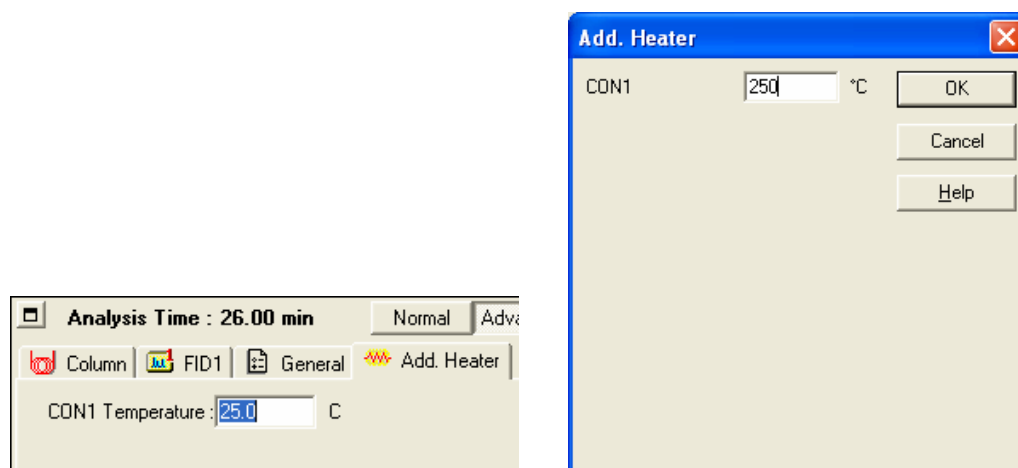
To start up the 2nd instrument, click the [2nd Instrument] icon on the [MDGC Real Time Analysis] window assistant bar.



Starting Up the 2nd Instrument

4.1.2 Setting the Interface Heater Temperature

First, set the temperature of the interface heater between the 1st GC and 2nd GCMS/GC. Normally, set the maximum temperature of the column oven temperature program.



Setting Additional Heater (left: GCsolution, right: GCMSsolution)

4.1.3 When the 2nd Instrument Is a GC

Enter the analysis conditions required for GC Real Time Analysis.

Set the column type and temperature conditions, and detector temperature and stop time.

The column oven temperature program can also be set from MDGCsolution.

Analysis Time : 26.00 min Normal Advanced

Column FID1 General Add. Heater

Temperature : 40.0 C

Equilibration Time : 3.0 min

Column Information (CBP1-W12-100)

Serial Number :

Installation Date : 07/09/11

Column Max. Temp : 320 C

Length : 12.0 m

Inner Diameter : 0.53 mm ID

Film Thickness : 1.00 um

Description :

Set....

250

0 10 20 min

Column Oven Temperature Program Redraw

	Rate	Temperature	Hold Time
0	-	40.0	0.00
1	10.00	250.0	5.00
2	0.00	0.0	0.00
3	0.00	0.0	0.00
4	0.00	0.0	0.00

Total Program Time : 26.00 min

Column Settings

Analysis Time : 26.00 min Normal Advanced

Column FID1 General Add. Heater

Temperature : 250 C

☒ Signal Acquire

Sampling Rate : 40 msec

Stop Time : 26.00 min

(Link to Oven Program)

Delay Time : 0.00 min

Subtract Detector : None

50

0 25 50 75 min

Flow Program Makeup Redraw

	Rate	Flow	Hold Time
0	-	30.0	0.00
1	0.00	0.0	0.00
2	0.00	0.0	0.00

Total Program Time : 0.00 min

Makeup Gas : He H2 Flow : 40.0 mL/min

Makeup Flow : 30.0 mL/min Air Flow : 400.0 mL/min

Detector Settings

4. Performing MDGC Real Time Analysis

4.1.4 When the 2nd Instrument Is a GCMS

Enter the analysis conditions required for GCMS Real Time Analysis.

Set the column type and temperature conditions, ion source, interface temperature, and mass spectrometer conditions. The column oven temperature program can also be set from MDGCsolution.

Inj. Port : Inj. Heat Port :

Column Oven Temp. : 50.0 °C °C

Injection Temp. : 250.0 °C

Injection Mode : [dropdown]

Sampling Time : 1.00 min

Carrier Gas

Flow Control Mode : [dropdown]

Pressure : 100.1 kPa

Total Flow : 50.0 mL/min

Column Flow : 1.69 mL/min

Linear Velocity : 47.2 cm/sec

Purge Flow : 10.0 mL/min

Split Ratio : -1.0

Program : Column Oven Temperature

	Rate	Final Temperature	Hold Time
0	-	50.0	1.00
1	0.00	0.0	0.00
2	0.00	0.0	0.00
3	0.00	0.0	0.00

Total Program Time : 1.00 min

Column

Name DB-5 ms Thickness : 0.25 um

Length : 30.0 m Diameter : 0.25 mm

Ready Check... Add Heater...

GC Program...

Prerun Program Time Program

GC Settings

GCMS-QP2010

Ion Source Temp. : 170 °C

Interface Temp. : 250 °C

Detector Voltage : ☐ Relative to the Tuning Result ☒ Absolute

Solvent Cut Time : 4 min

Micro Scan Width : 0 u

Threshold : 500

☐ Use MS Program : Set...

GC Program Time : 1.00 min

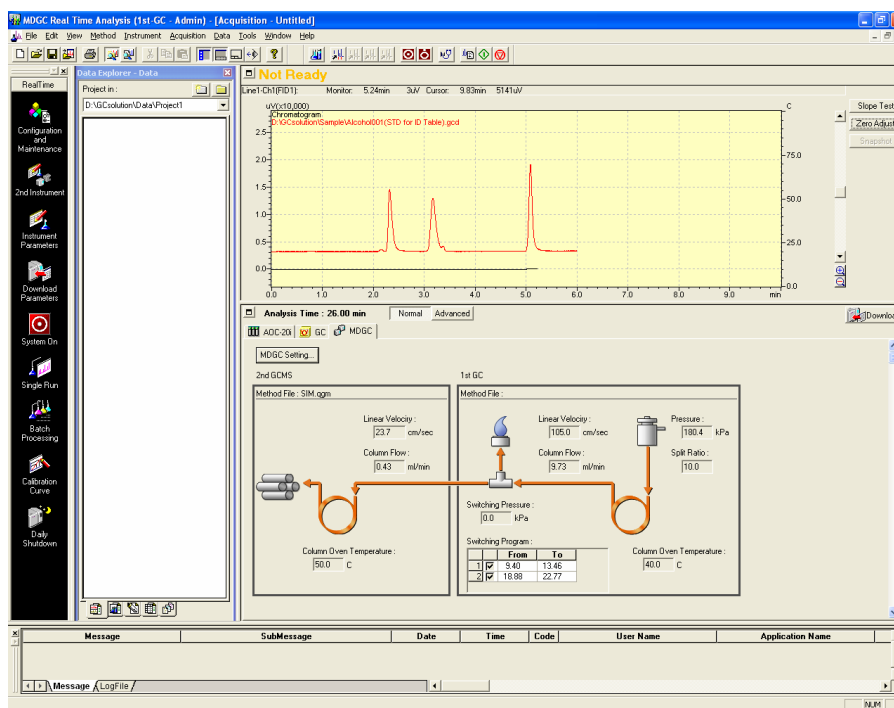
Group#1 - Event#1

	Start Time (min)	End Time (min)	Acq. Mode	Event Time(sec)	Scan Speed	Start m/z	End m/z	Ch1 m/z	Ch2 m/z	Ch3 m/z	Ch4 m/z
1	5.75	8.34	SIM	0.20				185.00	109.00	0.00	0.00
2	8.34	10.31	SIM	0.20				150.00	121.00	0.00	0.00
3	10.31	11.25	SIM	0.20				201.00	186.00	0.00	0.00
4	11.25	12.59	SIM	0.20				173.00	255.00	304.00	179.00
5	12.59	14.50	SIM	0.20				277.00	260.00	100.00	257.00
6	14.50	16.09	SIM	0.20				290.00	162.00	313.00	177.00

MS Settings

4.2 Setting 1st GC Method Files

4.2.1 MDGCsolution



[MDGC Real Time Analysis] Window

The upper half of the [MDGC Real Time Analysis] window is the chromatogram display area, and the lower half is the parameter setting area. The menu in the lower half can be switched by the following tabs.

The following tabs are displayed in the Normal mode.

- [AOC] tab: This tab page is for setting the autosampler injection conditions.
- [GC] tab: This tab page is for making GC-related settings, such as column over temperature and carrier gas pressure. This tab page could be described as grouping together the [INJ], [Column] and [DET] tab pages in the Advanced mode on the following page.
- [MDGC] tab: This tab page is for displaying the pressure settings of each component. The switching program can be set on this tab page.

4.2.2 Switching to the Advanced Mode

The following tabs are displayed when [Advanced] is clicked to switch to the Advanced mode.

- | | |
|----------------|---|
| [AOC] tab: | This tab page is for setting the autosampler injection conditions. |
| [INJ] tab: | This tab page is for setting the temperature and pressure of the injector. |
| [Column] tab: | This tab page is for setting the column oven temperature program. |
| [DET] tab: | This tab page is for making 1st GC detector-related settings, such as detector temperature. |
| [General] tab: | This tab page is for setting indirect conditions, such as the ready check and time program. |

4.2.3 Setting GC Conditions

When you have made a new method file, select each of the tabs in the Advanced mode to enter the GC Real Time Analysis conditions.

- Set the sample injection conditions on the [AOC] tab page.

The screenshot shows the [AOC] Tab Page of the software interface. At the top, there is a status bar with a square icon, 'Analysis Time : 36.00 min', and two tabs: 'Normal' and 'Advanced'. Below this is a navigation bar with three icons and labels: 'AOC-20i', 'GC', and 'MDGC'. The main area contains several settings:

- Injection Volume : 1.0 uL (10.0 uL syringe)
- # of Rinses with Solvent(Pre-run) : 0
- # of Rinses with Solvent(Post-run) : 1
- # of Rinses with Sample : 2
- Plunger Speed(Suction) : ☒ High ☐ Middle ☐ Low
- Viscosity Comp. Time : 0.2 sec
- Plunger Speed(Injection) : ☒ High ☐ Middle ☐ Low
- Syringe Insertion Speed : ☒ High ☐ Low
- Injection Mode : Normal

There are two buttons at the bottom right: 'Set...' and 'Advanced...'.

[AOC] Tab Page

- On the [INJ] tab page, set the carrier gas pressure and flow rate, injection mode and other injection conditions.

Analysis Time : 36.00 min Normal Advanced

ADC-20i SPL1 Column FID1 General Add. Flow MDGC

Temperature : 250.0 C kPa

Injection Mode : Split

Sampling Time : 1.00 min

Carrier Gas : He

Flow Control Mode : Pressure

Pressure : 100.0 kPa

Total Flow : 49.9 mL/min

Column Flow : 4.26 mL/min

Linear Velocity : 60.3 cm/sec

Purge Flow : 3.0 mL/min

Split Ratio : 10.0

INJ. Program : Pressure Redraw

	Rate	Pressure	Hold Time
0	-	100.0	0.00
1	0.00	0.0	0.00
2	0.00	0.0	0.00

Total Program Time : 0.00 min Advanced...

Column Information (CBP1-S25-050)

Length : 25.0 m Film Thickness : 0.50 um

Inner Diameter : 0.32 mm ID

[INJ] Tab Page

- On the [Column] tab page, set the equilibration time and temperature program.

Analysis Time : 36.00 min Normal Advanced

ADC-20i SPL1 Column FID1 General Add. Flow MDGC

Temperature : 40.0 C

Equilibration Time : 3.0 min

Column Information (CBP1-S25-050)

Serial Number :

Installation Date : 07/09/11

Column Max. Temp : 320 C

Length : 25.0 m

Inner Diameter : 0.32 mm ID

Film Thickness : 0.50 um

Description :

Set....

Column Oven Temperature Program Redraw

	Rate	Temperature	Hold Time
0	-	40.0	10.00
1	10.00	250.0	5.00
2	0.00	0.0	0.00
3	0.00	0.0	0.00

Total Program Time : 36.00 min

[Column] Tab Page



The maximum temperature of the MDGC switching device is 350°C. Set the temperature program within the range up to 350°C.

4. Performing MDGC Real Time Analysis

- On the [DET] tab page, make the detector settings. For an FID, in particular, set the H2 and air flow rates on this tab page.

Analysis Time : 36.00 min Normal Advanced

ADC-20i SPL1 Column FID1 General Add. Flow MDGC

Temperature : 250.0 C

☒ Signal Acquire

Sampling Rate : 40 msec

Stop Time : 36.00 min

(Link to Oven Program)

Delay Time : 0.00 min

Subtract Detector : None

mL/min

Flow Program : Makeup Redraw

	Rate	Flow	Hold Time
0	-	30.0	0.00
1	0.00	0.0	0.00
2	0.00	0.0	0.00

Total Program Time : 0.00 min

Makeup Gas : He H2 Flow : 40.0 mL/min

Makeup Flow : 30.0 mL/min Air Flow : 400.0 mL/min

[DET] Tab Page

- On the [General] tab page, set the ready check and time program, if required.

Analysis Time : 36.00 min Normal Advanced Download

ADC-20i SPL1 Column FID1 General Add. Flow MDGC

Ready Check

Heat Unit : Injection Flow : ☒ SPL1 Carrier

☒ Column ☒ SPL1 Purge

☒ SPL1

☒ FID1

Add. Flow : ☒ APC1

Detector(FTD) : Detector APC Flow : ☒ FID1 Makeup

Baseline Drift : ☒ FID1 H2

☒ External Wait ☒ FID1 Air

Prerun Program :

	Time	Device	Event	Value
1	0.00			
2	0.00			
3	0.00			

Total Program Time : 0.00 min

Time Program :

	Time	Device	Event	Value
1	0.00			
2	0.00			
3	0.00			

Total Program Time : 0.00 min

Auto

☒ Auto Flame On ☒ Auto Zero after Ready

☒ Auto Flame Off

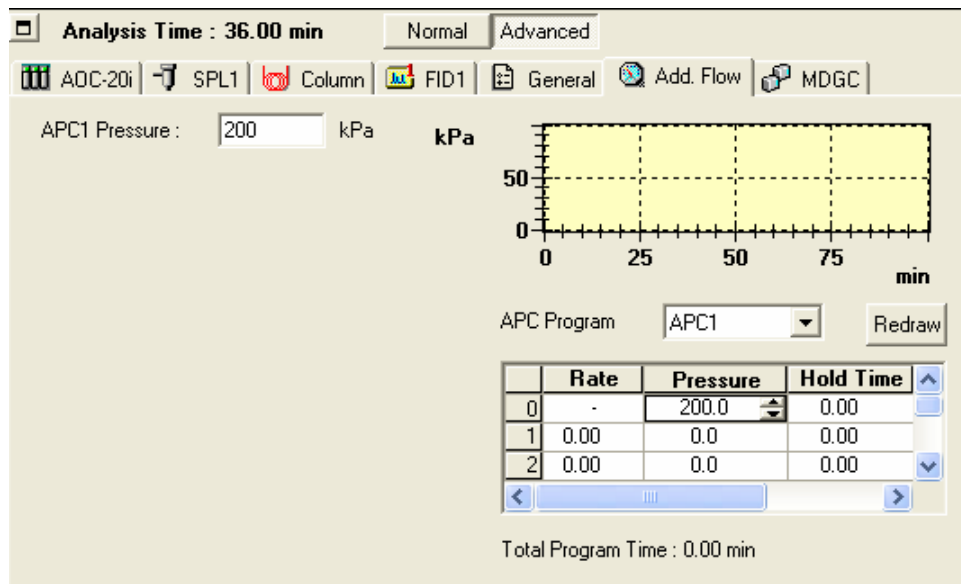
☐ Reignite

[General] Tab Page



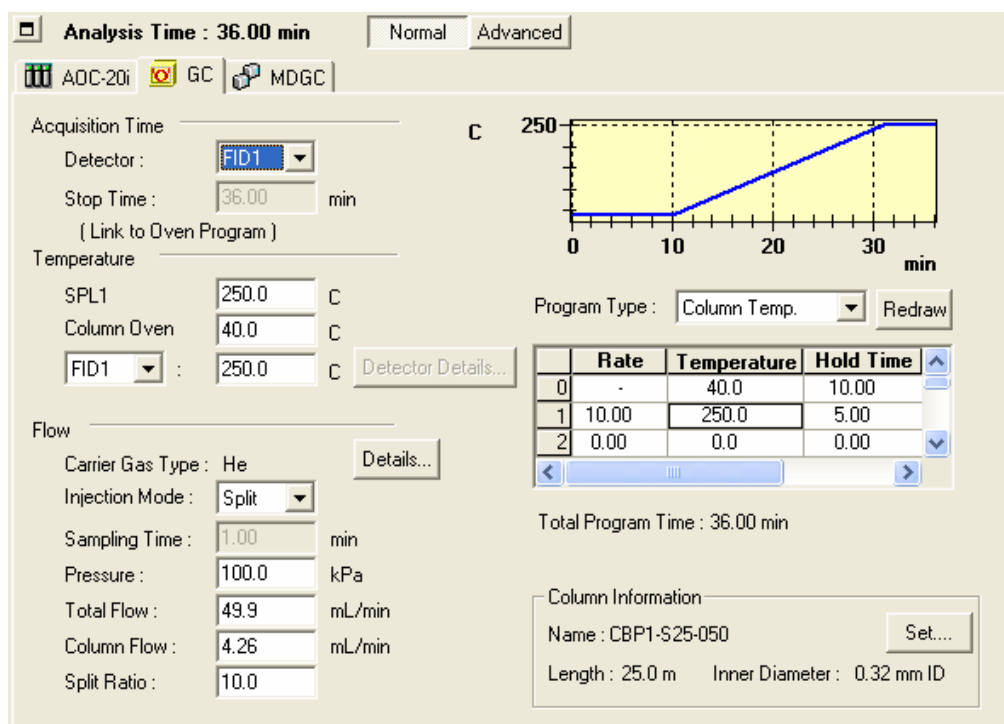
When [External Wait] is set to Off, the READY signal of the 2nd instrument cannot be detected properly.

- On the [Add.Flow] tab page, the switching pressure is displayed. Set the switching pressure in the [MDGC Setting] window since recovery can be viewed while setting the pressure in this window.



[Add.Flow] Tab Page

- In the Advanced mode, all parameters can be displayed and set. However, to set only GC-related main parameters, click the [Normal] (mode) button. These parameters are grouped together on the [GC] tab page so there is no need to switch the tab.

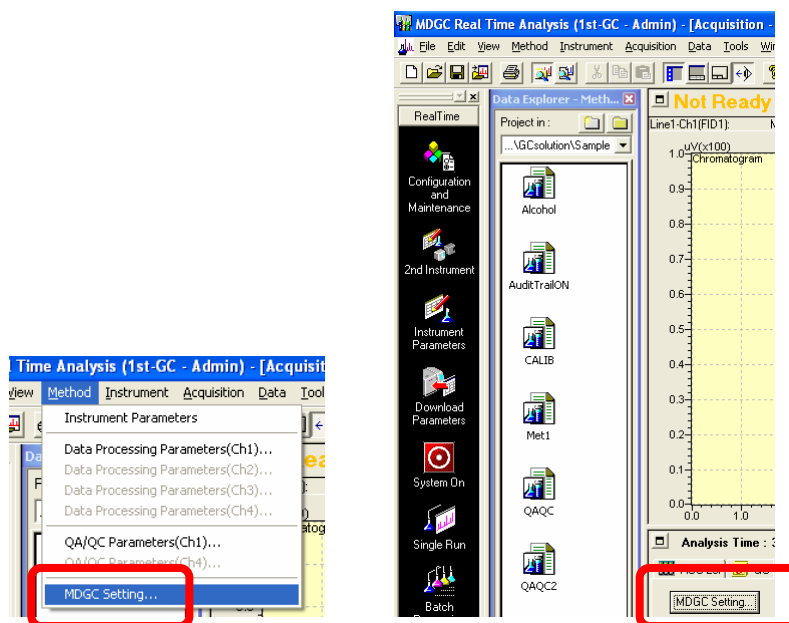


[GC] Tab Page in Normal Mode

4. Performing MDGC Real Time Analysis

4.2.4 Starting Up the [MDGC Setting] Window

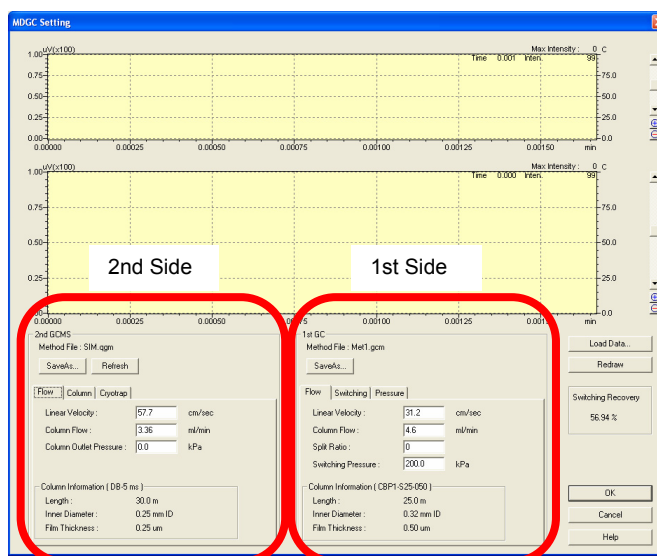
Temperature and pressure conditions can be entered in the [MDGC Setting] window. To open this window, click the [MDGC Setting] button on the [MDGC] tab or click [MDGC Setting] under the method.



Opening the [MDGC Setting] Window

The upper half of this window is the chromatogram display area, and the lower half contains the various setting areas. The following items can be set and displayed.

"1st GC carrier gas settings", "switching pressure settings", "switching program settings", "2nd GCMS/GC oven temperature settings", "column outlet APC pressure", "cryo trap settings", "sample recovery of 1st GC→2nd side column", "2nd GCMS/GC carrier gas flow rate calculation"



[MDGC Setting] Window

4.2.5 Setting the Carrier Gas Pressure

To set the carrier gas pressure, click the 1st GC [Pressure] tab. The pressure program can also be used.

	Rate	Pressure	Hold Time
0	-	250.0	0.00
1	0.00	0.0	0.00
2	0.00	0.0	0.00
3	0.00	0.0	0.00
4	0.00	0.0	0.00

Total Program Time :

[Pressure] Tab Page

4.2.6 Setting the Switching Pressure and Column Flow Rate

Click the 1st GC [Flow] tab, and set [Switching Pressure]. [Switching Pressure] must be set lower than the carrier gas pressure.

Next, set [Column Flow], or [Linear Velocity] and [Split Ratio]. [Column Information] is displayed underneath these items.

Flow | Switching | Pressure

Linear Velocity : cm/sec

Column Flow : ml/min

Split Ratio :

Switching Pressure : kPa

Column Information (CBP1-S25-050)

Length : 25.0 m

Inner Diameter : 0.32 mm ID

Film Thickness : 0.50 um

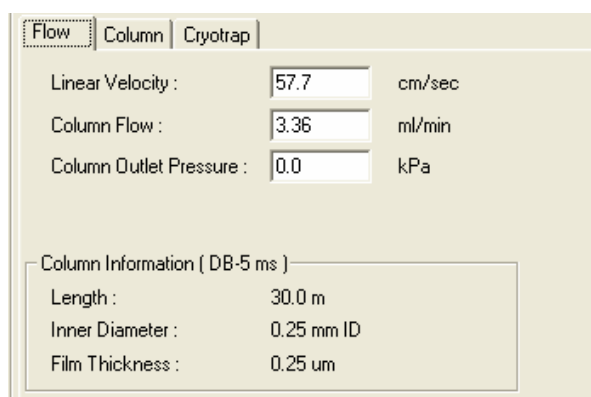
[Flow] Tab Page (1st GC)

4. Performing MDGC Real Time Analysis

4.2.7 2nd GCMS/GC Setting Items

The [Flow], [Column] and [Cryotrap] settings are displayed in the 2nd GCMS/GC display area.

The linear velocity and flow rate of the 2nd column are displayed when the [Flow] tab is clicked. These items can also be edited on the [Flow] tab page.



Flow | Column | Cryotrap

Linear Velocity : 57.7 cm/sec

Column Flow : 3.36 ml/min

Column Outlet Pressure : 0.0 kPa

Column Information (DB-5 ms)

Length : 30.0 m

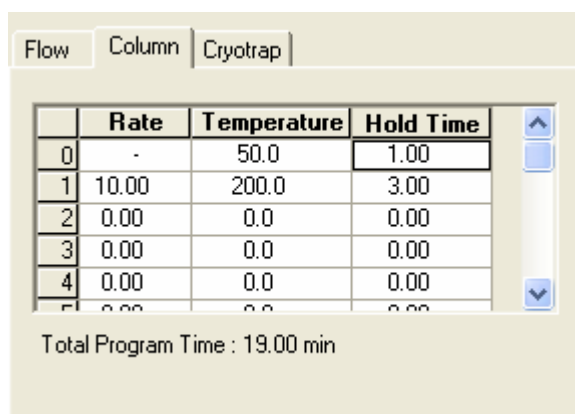
Inner Diameter : 0.25 mm ID

Film Thickness : 0.25 um

[Flow] Tab Page (2nd GCMS/GC)

The column oven temperature of the 2nd GCMS/GC is displayed when the [Column] tab is clicked.

The column oven temperature program can be edited on the [Column] tab page.



Flow | Column | Cryotrap

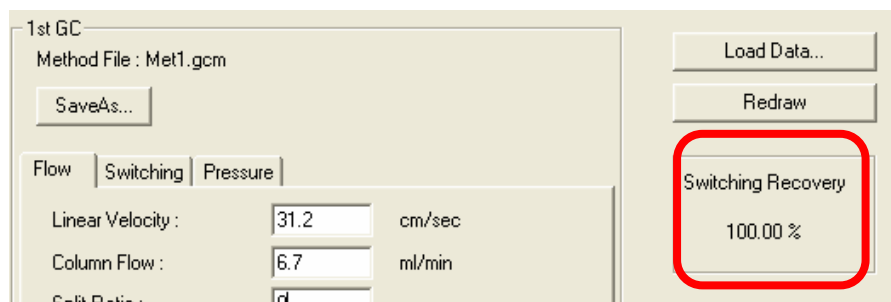
	Rate	Temperature	Hold Time
0	-	50.0	1.00
1	10.00	200.0	3.00
2	0.00	0.0	0.00
3	0.00	0.0	0.00
4	0.00	0.0	0.00
5	0.00	0.0	0.00

Total Program Time : 19.00 min

[Column] Tab Page

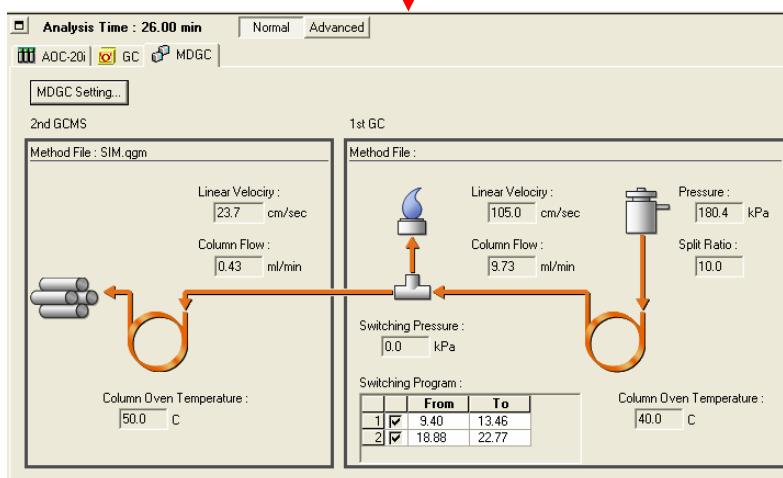
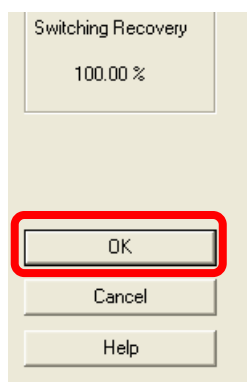
4.2.8 Displaying the Analysis Conditions

The [Switching Recovery] item is re-calculated and displayed each time that the pressure and temperature are entered. The "switching recovery" index indicates the efficiency of the 1st column/2nd column switching function in MDGC (It is not always match to actual value) Real Time Analysis. Set the method so that the switching recovery value is 100%.



[Switching Recovery] Display

After setting the analysis conditions, click [OK]. This closes the [MDGC Setting] window, and the analysis conditions and flow path are displayed on the [MDGC] tab page.

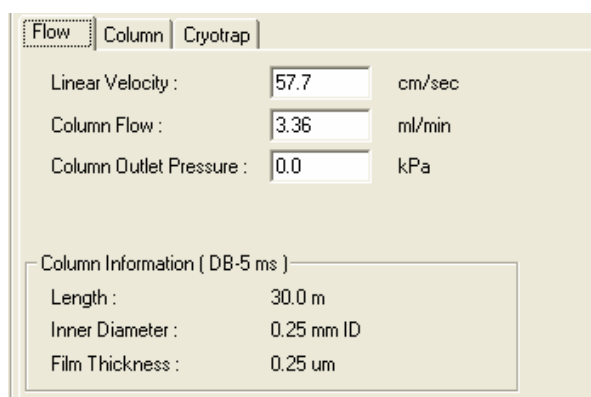


Analysis Conditions Display

4.2.9 Other Setting Items

Normally, the [Column Outlet Pressure] and [Cryotrap] settings are not used. Use these settings when optional modules are connected.

[Column Outlet Pressure] is displayed when the [2nd column outlet press] checkbox is selected at System Configuration.



Flow | **Column** | Cryotrap

Linear Velocity : 57.7 cm/sec

Column Flow : 3.36 ml/min

Column Outlet Pressure : 0.0 kPa

Column Information (DB-5 ms)

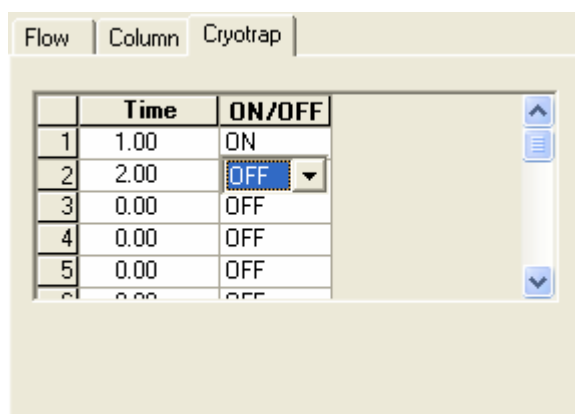
Length : 30.0 m

Inner Diameter : 0.25 mm ID

Film Thickness : 0.25 um

Column Outlet Pressure

The [Cryotrap] tab page is displayed when the [Cryo Trap] checkbox is selected at System Configuration.



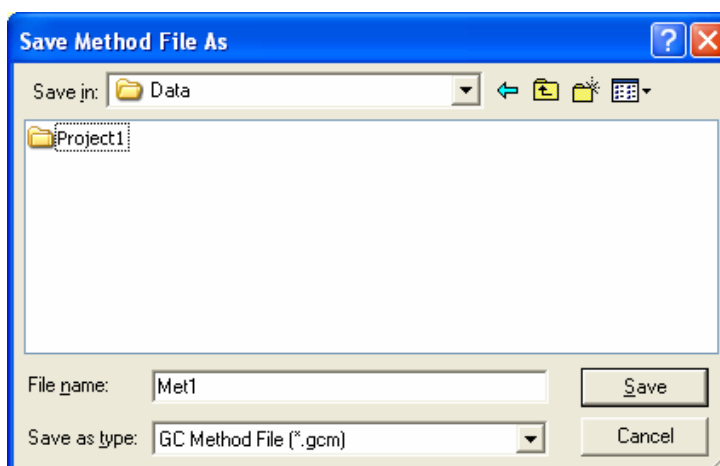
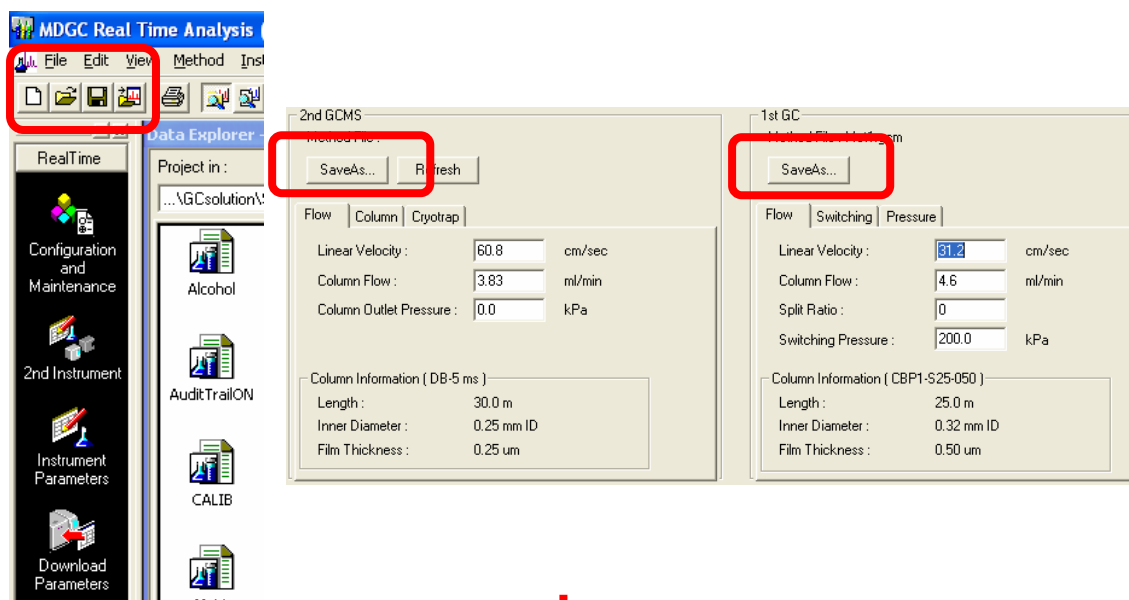
Flow | Column | **Cryotrap**

	Time	ON/OFF
1	1.00	ON
2	2.00	OFF
3	0.00	OFF
4	0.00	OFF
5	0.00	OFF
6	0.00	OFF

[Cryotrap] Tab Page

4.3 Saving Method Files

The buttons, [Save As], is provided for MDGC Real Time Analysis. The [Save As] button is for saving method files under a new name. If parameters are changed or saved not in the [MDGC Real Time Analysis] but in the 2nd side GCMSsolution or GCsolution, the parameters can be updated to the latest settings by clicking the [Refresh] button. When selection and setting of the 2nd side method file are completed, also save the 1st side method. To save the 1st side method, click [Save Method File As] or [Save Method File] on the [MDGC Real Time Analysis] tool bar or in the [File] menu. The [Save As] button is also located in the 1st GC area at the bottom of the window. This button is provided for making and saving multiple method files while changing analysis conditions.

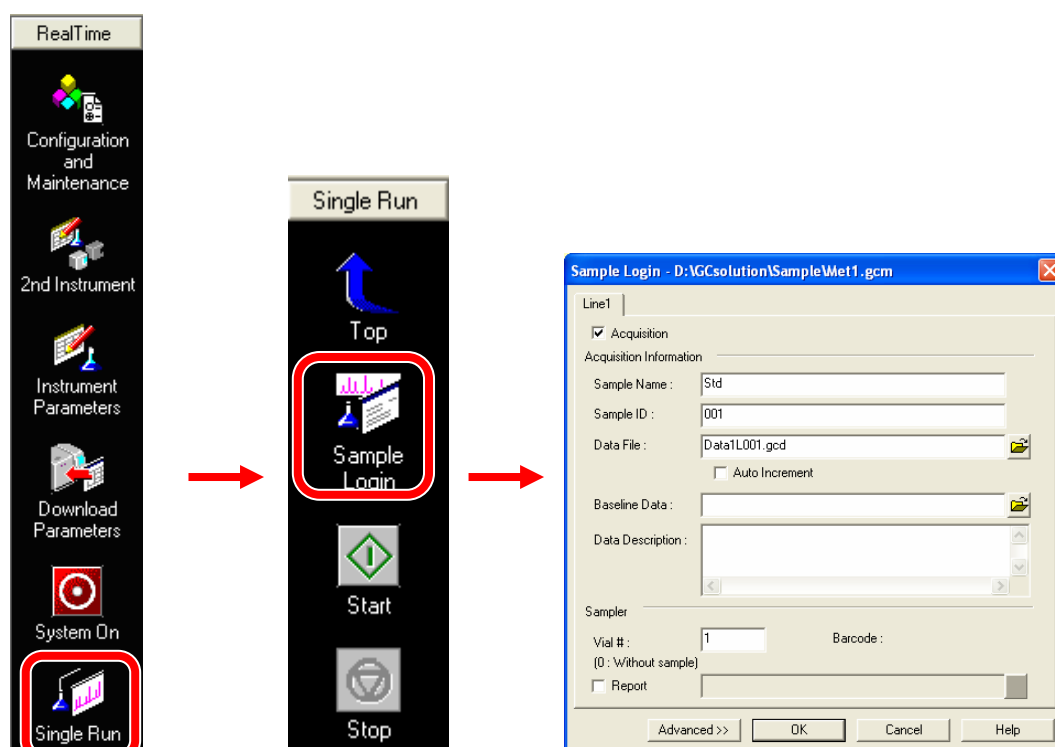


4.4 Performing Analysis In the Standby Mode

First, perform analysis in the Standby mode, and check the chromatogram that is detected by the 1st GC monitor detector. For this analysis, perform Single Run. As its name implies, "Single Run" refers to performing analysis once only. However, when the analysis conditions and data are saved beforehand, the data file name must be saved, and when the autosampler is used, sample Nos., etc. must be saved beforehand. The following describes how to make these settings.

4.4.1 Sample Login

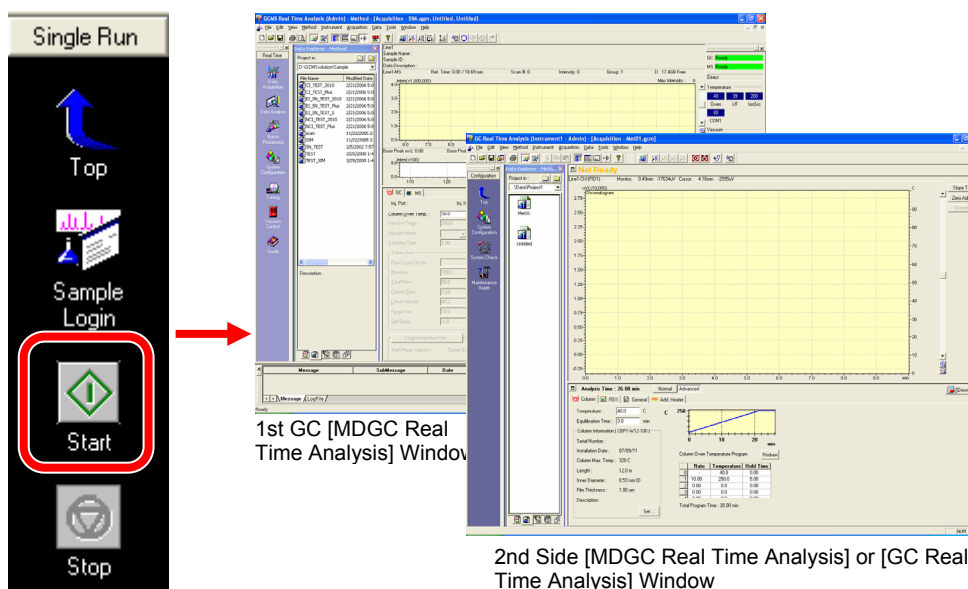
Click the [Single Run] icon on the assistant bar in the [MDGC Real Time Analysis] window. Next, click the [Sample Login] icon.



Enter the [Sample Name], [Sample ID] and [Data File] settings, and the [Vial #] setting when an autosampler is used. When entry is completed, click [OK] to register the sample.

4.4.2 Starting Single Run

Start Single Run from the [MDGC Real Time Analysis] window. Execute Sample Login in the [MDGC Real Time Analysis] window. When analysis is started, analysis in the 2nd side [Real Time Analysis] window also is started interlocked with the 1st side window.



Click the [Start] icon on the assistant bar in the [MDGC Real Time Analysis] window to set the 1st GC and 2nd GCMS/GC to the Standby mode. In this mode, the Sample Information (i.e. Sample Name, Sample ID, Vial #, Sample Type, ISTD Amount, and Sample Amount) of the Sample Login details set on the 1st GC are also set on the 2nd GCMS/GC as they are. Also, the file name set on 1st GC appended with "-2D" is set on the 2nd GCMS/GC as the data file name.

Analysis is started at the same time that the sample is injected, and data is acquired in each of the Real Time Analysis windows and saved to data files.

4.4.3 Stopping Single Run

To stop Single Run midway, click the [Stop] icon on the assistant bar in the [MDGC Real Time Analysis] window. When the [Stop] icon is clicked, GC program also stops.



During analysis if an error occurred in 1stGC or 2nd instrument, both analysis will be stopped.



When Single Run is stopped from the menu or the [Stop] icon, or Single Run is stopped midway due to an error, the carrier gas is automatically switched to flow to the monitor detector (1st GC).

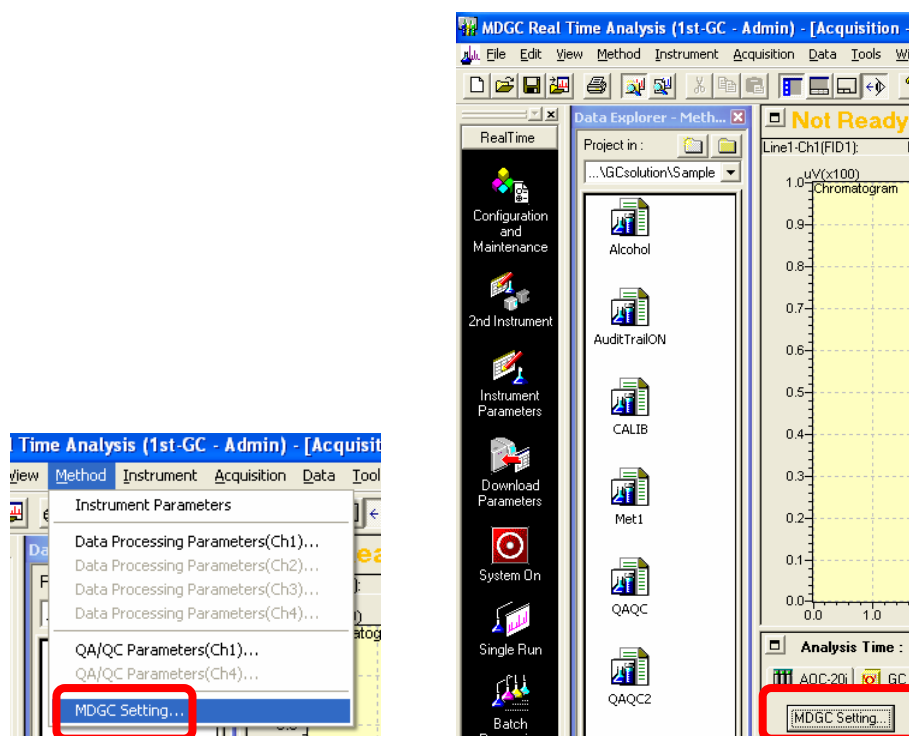
The purpose of this is to stabilize the 1st GC baseline before the next analysis is performed.

4.5 Checking Chromatograms

Check the chromatogram of the monitor detector (1st GC). Though the chromatogram can be opened by GC Postrun, the following describes how to check the chromatogram in the [MDGC Setting] window.

4.5.1 Opening the [MDGC Setting] Window

Open the [MDGC Setting] window from the [Method] menu in the [MDGC Real Time Analysis] window.

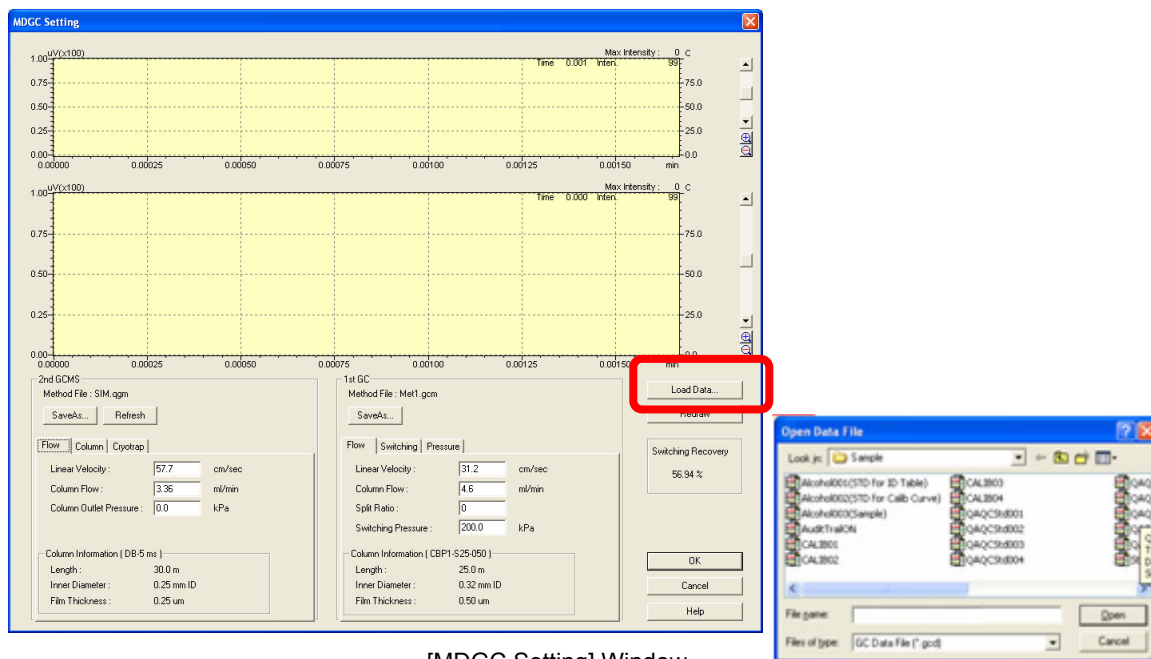


Opening the [MDGC Setting] Window

4. Performing MDGC Real Time Analysis

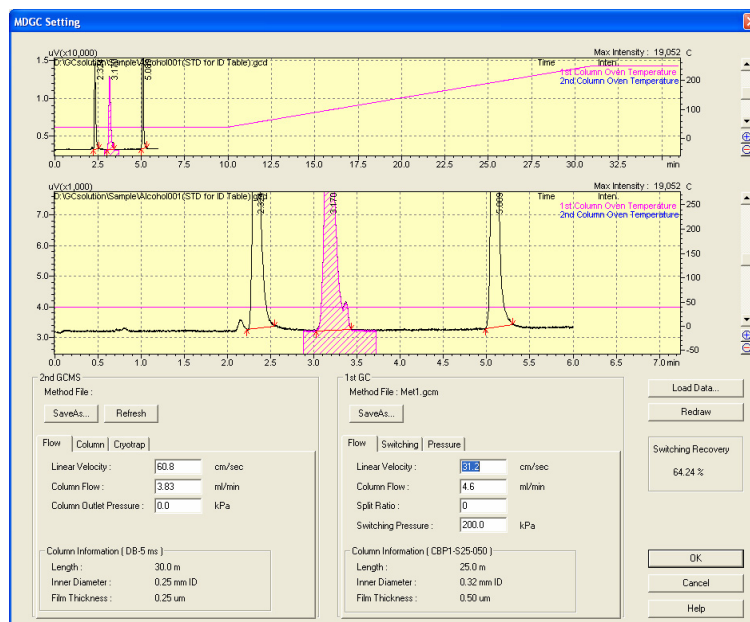
4.5.2 Loading Chromatograms

Click [Load Data], and specify the data file to be displayed.



[MDGC Setting] Window

The chromatogram is displayed. The column oven temperature and carrier gas pressure program curves also can be displayed by changing the display settings.



Chromatogram Display

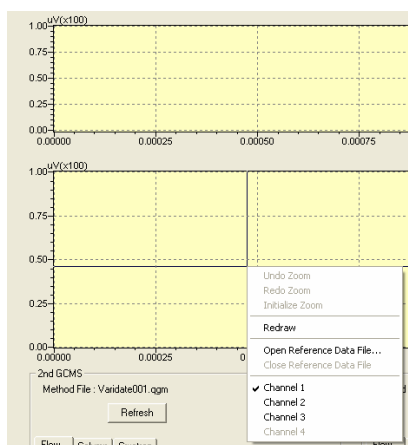
The display in the upper half of the window is the entire chromatogram. Dragging a specific area in the upper half of the window displays the selected area of the chromatogram enlarged in the lower half of the window.

When the pattern of this chromatogram is judged as being valid, next set up switching and perform analysis. If the settings are judged as requiring changes, change the analysis conditions, and perform analysis again.



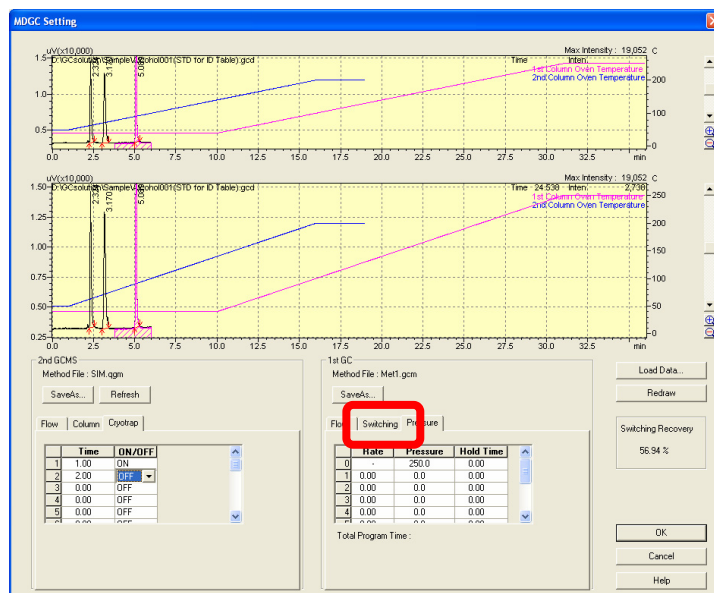
How to Display Chromatograms of Channels Other Than Channel 1

Though multiple lines are not supported on MDGCsolution, chromatograms saved to channels other than channel 1 can be specified when data acquired on other GCs must be loaded to the [MDGC Setting] window. To do this, right-click on the chromatogram display area to display the channel selection menu.



4.6 Setting the Switching Timing

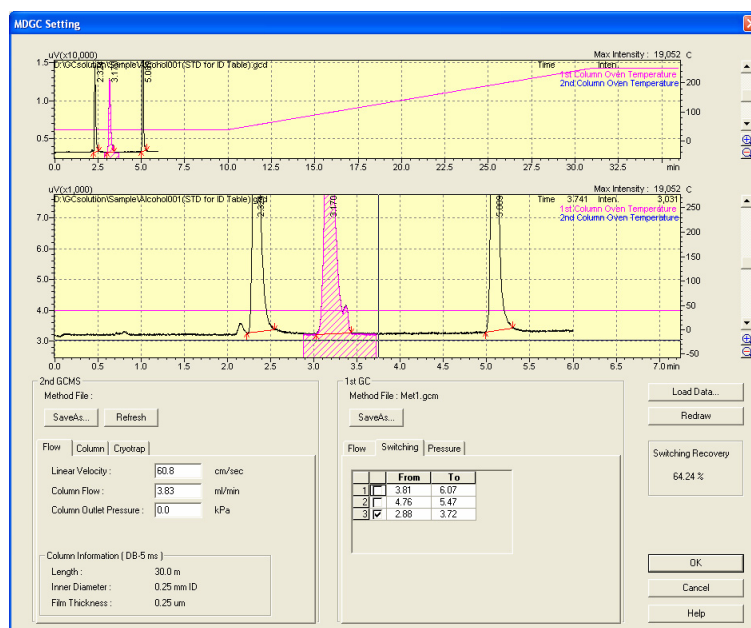
Click the 1st GC [Switching] tab in the [MDGC Setting] window.



Select the range to perform switching in. Double-click the start point ([From]) and then the end point ([To]) on the chromatogram. This selects the range, and opens the [Switching range] setting window. Clicking [Add] displays the fraction to be switched masked by diagonal lines.

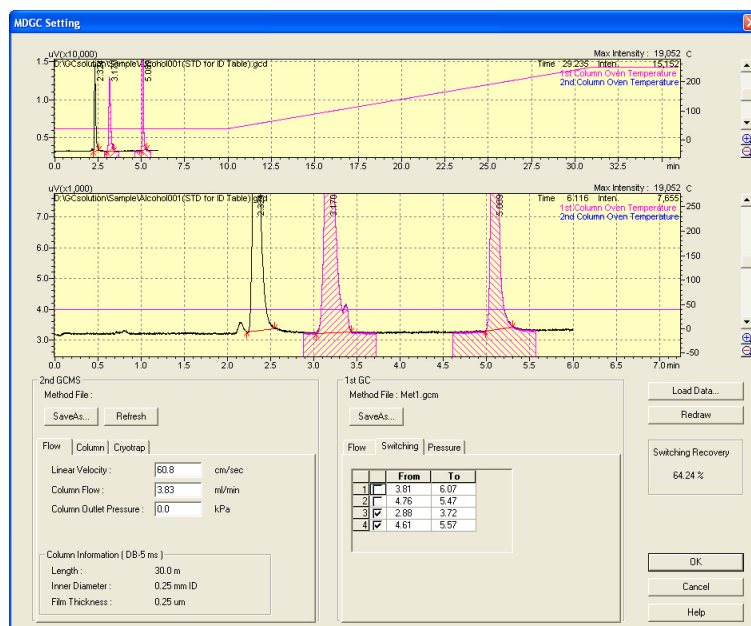


4. Performing MDGC Real Time Analysis



Switching Range Display

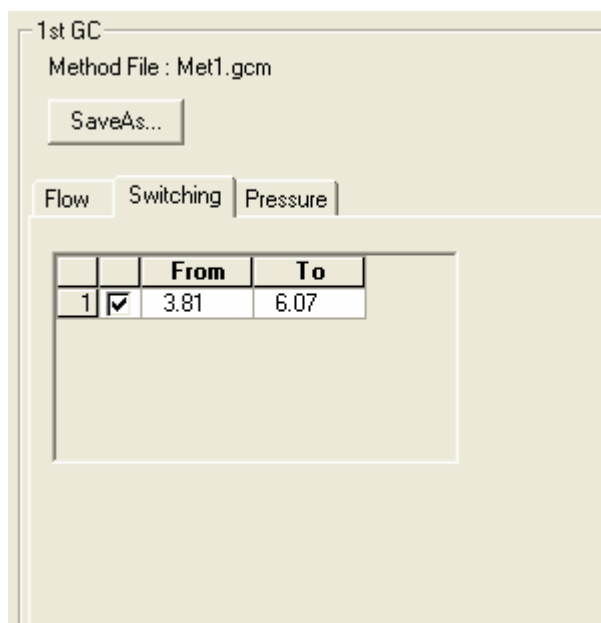
Multiple switching programs can also be set by repeating the above operation.



Setting Multiple Switching Ranges (Example)

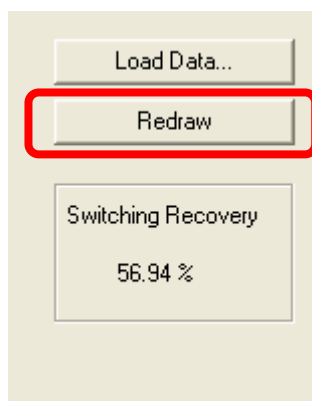
4.7 Changing the Switching Timing

The currently set switching program is displayed on the 1st GC [Switching] tab page. The start and end times in this program can be changed directly. Also, switching settings can be disabled by deselecting the respective checkbox on the left.



Switching Program

When the switching program has been changed in this window, the diagonal line sections in the chromatogram display area of the upper half of the window can be refreshed by clicking [Redraw].



[Redraw] Button

4.8 Performing MDGC Real Time Analysis

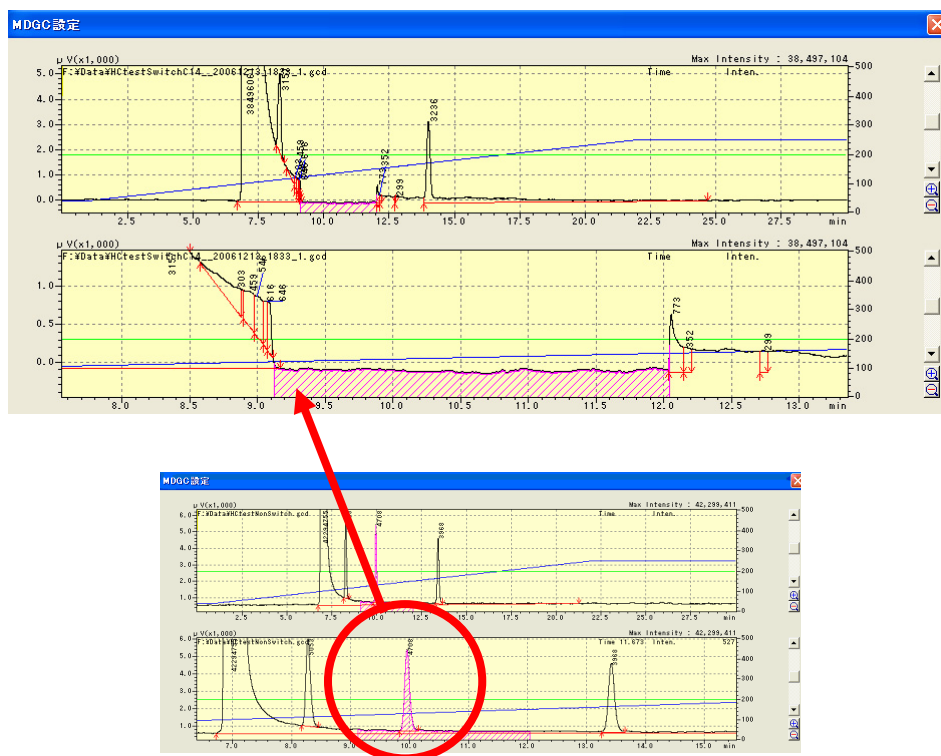
Measure the same sample again after making the switching settings.

4.8.1 Performing Single Run

Before performing Single Run again, save the method for MDGC Real Time Analysis. When analysis is started and the switching start time is reached, the baseline of the 1st GC monitor detector drops, and peaks are no longer detected. When switching ends, the baseline returns to its original height, and peaks are detected again. On the other hand, eluted peaks are observed in the switched range in the 2nd GCMS/GC chromatogram.

4.8.2 Checking the Switching Range

Load the chromatogram to the [MDGC Setting] window, and check that the peaks in the switching range have disappeared. (Peaks do not appear since this section has been introduced to the 2nd column.)



1st GC Switching Range

(The diagonal line section in the upper figure. The lower figure shows the data in the Standby mode.)

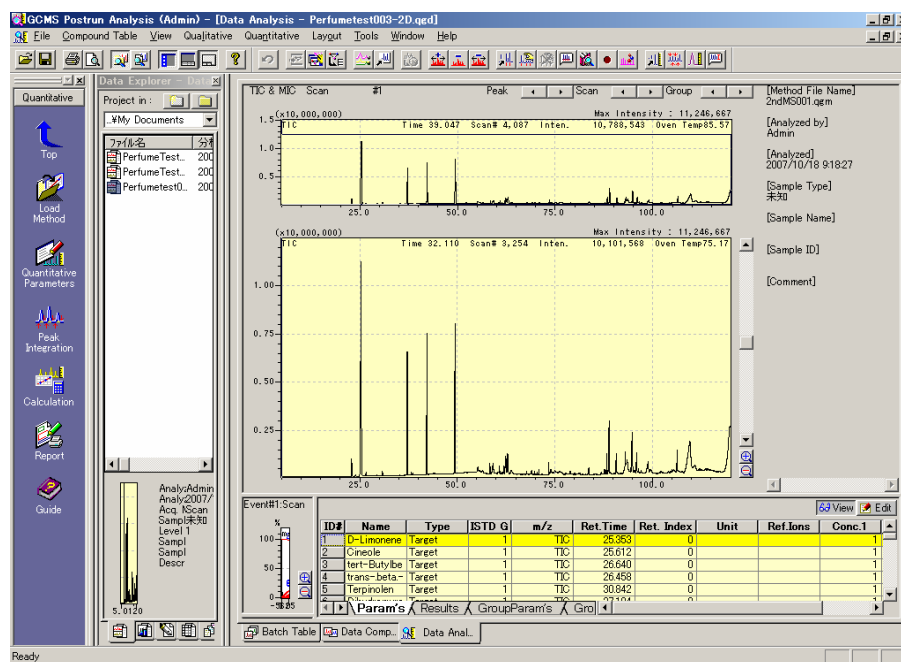
4. Performing MDGC Real Time Analysis

4.8.3 Checking 2nd Side Data

Check 2nd GCMS/GC data in the [Postrun] window.

To do this, click the [GC Postrun] or [GCMS Postrun] icon on the Launcher to open the [Postrun] window, and then load the data file.

Check the separation state of the peaks from the chromatogram peak shapes or the mass spectrum (in the case of a GCMS).



Checking 2nd GCMS/GC Data

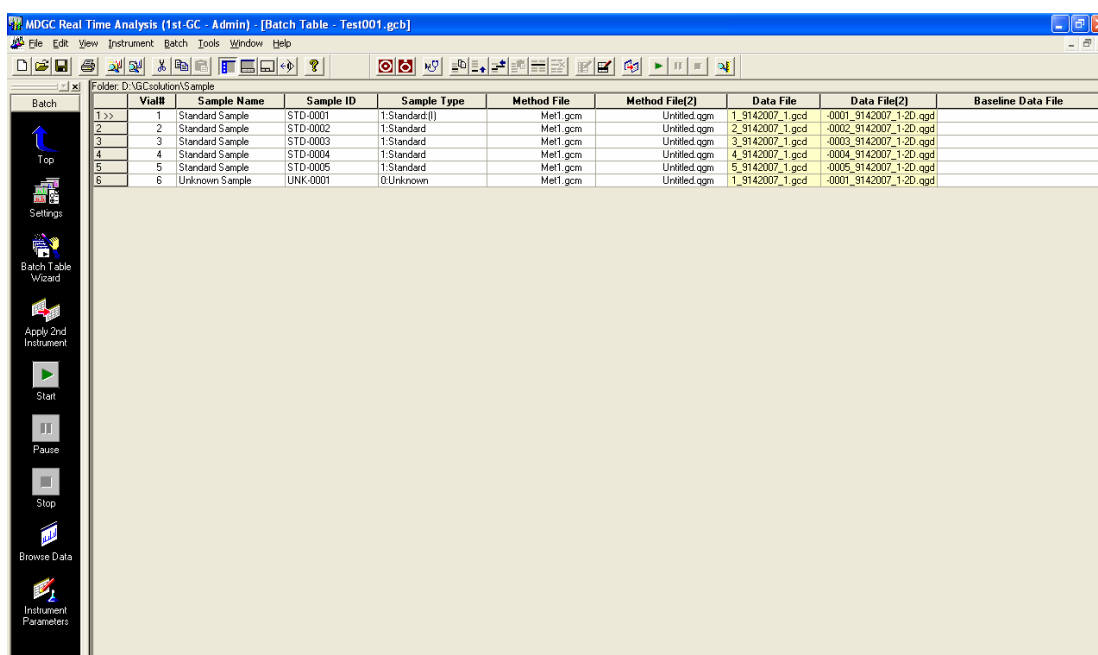


If peaks are not detected, a probable cause is inappropriate 2nd column selection or analysis conditions.

5.Executing Continuous Analysis - Batch Analysis

Continuous measurements can be made for multiple times by using MDGCsolution's Batch Analysis function. "Batch Analysis" refers to the setting for performing analysis for multiple times. With this function, multiple rows are set beforehand, with each row containing conditions (method file, data file, etc.) set for a single analysis. Normally, Batch Analysis is used with an autosampler connected to the instrument.

Start Batch Analysis from the [MDGC Real Time Analysis] window. When a Batch Table is made in the [MDGC Real Time Analysis] window, and Batch Analysis is started, analysis in the 2nd GCMS/GC [Real Time Analysis] window also is started interlocked with the 1st side window.



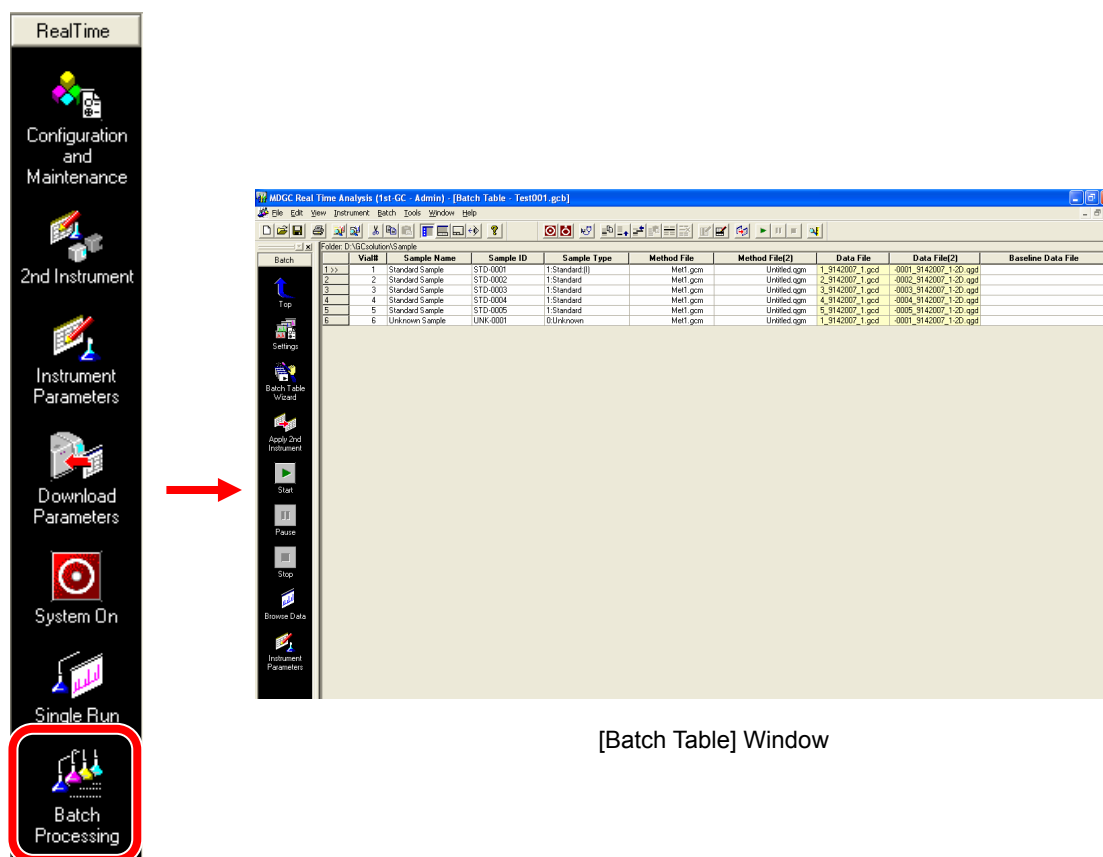
Batch Analysis Setting Window

5.1 Setting Batch Analysis

Batch Analysis operations and setup in MDGCsolution are basically the same as those of Batch Analysis performed in the standard GCsolution.

5.1.1 Starting Up Batch Analysis

To open the [Batch Table] window, click the [Batch Processing] icon on the assistant bar in the [MDGC Real Time Analysis] window.



[Batch Table] Window

5.1.2 Setting the Batch Table

[Method File] must be set in the Batch Table in addition to sample information, such as the [Vial#], [Sample Name], [Sample ID], and [Sample Type] setting items.

Set the 2nd GCMS/GC method file in the [Method File (2)] column.

When the [Data File] is set, the name of the data file on the 2nd instrument is automatically set to the [Data File (2)] column. The data file at [Data File (2)] is the file name set at [Data File] appended with "-2D".

		(1st)		(2nd)		(1st)		(2nd)	
Vial#	Sample Name	Sample ID	Sample Type	Method File	Method File(2)	Data File	Data File(2)		
1	Standard Sample	STD-0001	1:Standard(I)	Met1.gcm	Untitled.qgm	1_9142007_1.gcd	-0001_9142007_1-2D.qgd		
2	Standard Sample	STD-0002	1:Standard	Met1.gcm	Untitled.qgm	2_9142007_1.gcd	-0002_9142007_1-2D.qgd		
3	Standard Sample	STD-0003	1:Standard	Met1.gcm	Untitled.qgm	3_9142007_1.gcd	-0003_9142007_1-2D.qgd		
4	Standard Sample	STD-0004	1:Standard	Met1.gcm	Untitled.qgm	4_9142007_1.gcd	-0004_9142007_1-2D.qgd		
5	Standard Sample	STD-0005	1:Standard	Met1.gcm	Untitled.qgm	5_9142007_1.gcd	-0005_9142007_1-2D.qgd		
6	Unknown Sample	UNK-0001	0:Unknown	Met1.gcm	Untitled.qgm	1_9142007_1.gcd	-0001_9142007_1-2D.qgd		

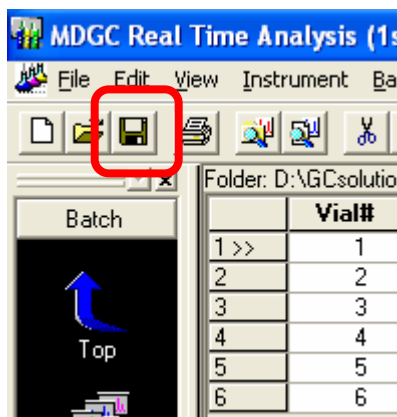
Batch Analysis Table



The background of [Data File (2)] is displayed in yellow to indicate that the user cannot enter data in this column.

5.1.3 Saving Batch Files

Save the batch file when batch file settings are completed.

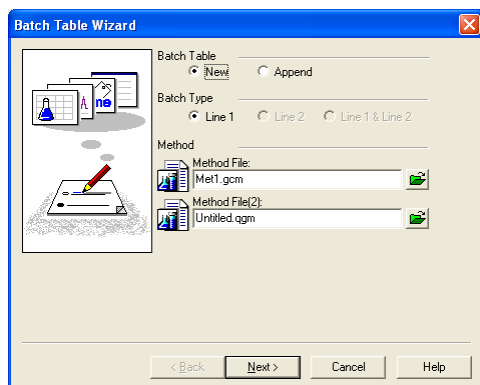


Saving Batch Files

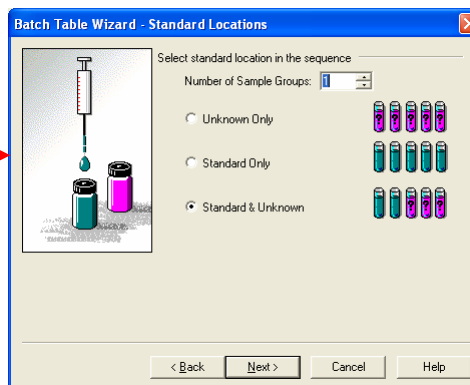
5. Executing Continuous Analysis - Batch Analysis

5.1.4 Creating a Batch Table Using [Batch Table Wizard]

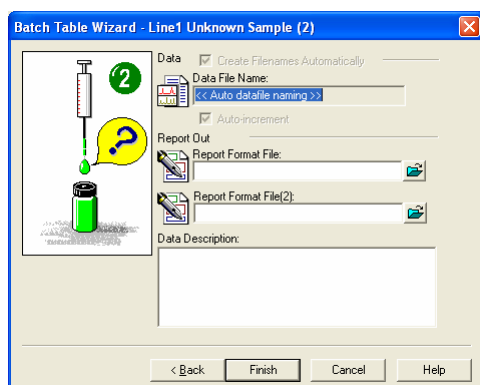
To open [Batch Table Wizard], click the [Batch Table Wizard] icon. A Batch Table can be created easily in [Batch Table Wizard] by setting [Method File], [Sample Type], [Sample Count], and [Data File Name] according to the on-screen instructions.



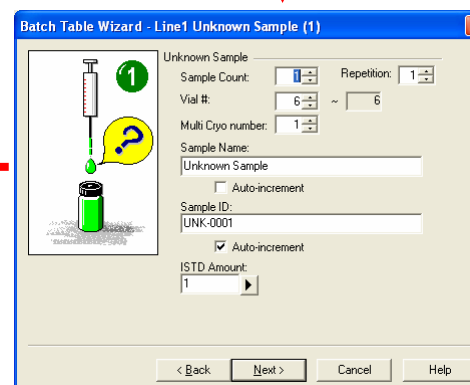
Setting [Method File]



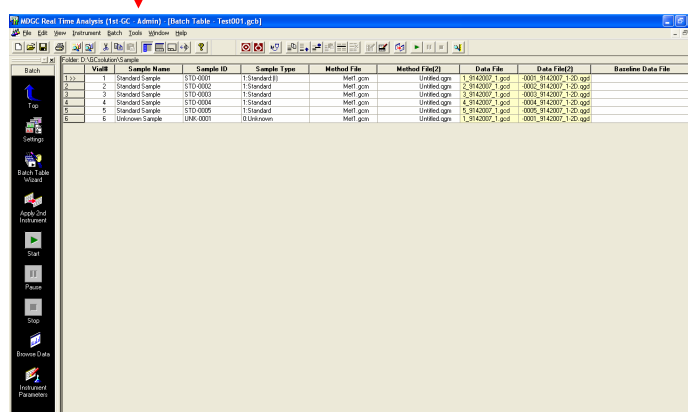
Setting [Sample Type]



Setting [Data File Name]



Setting [Sample Count]



The screenshot shows the 'MDGC Real Time Analysis (1st GC - Admin) - Batch Table - Test001.qc6' window. It displays a table of batch data with columns: Vial#, Sample Name, Sample ID, Sample Type, Method File, Method File(2), Data File, Data File(2), and Random Data File. The table contains 6 rows of data for standard and unknown samples.

Vial#	Sample Name	Sample ID	Sample Type	Method File	Method File(2)	Data File	Data File(2)	Random Data File
1	Standard Sample	S10-0000	1 Standard	Met1.qgm	Untitled.qgm	1_S10-0000_1.qgm	0000_S10-0000_1.qgm	
2	Standard Sample	S10-0001	1 Standard	Met1.qgm	Untitled.qgm	2_S10-0001_1.qgm	0001_S10-0001_1.qgm	
3	Standard Sample	S10-0002	1 Standard	Met1.qgm	Untitled.qgm	3_S10-0002_1.qgm	0002_S10-0002_1.qgm	
4	Standard Sample	S10-0003	1 Standard	Met1.qgm	Untitled.qgm	4_S10-0003_1.qgm	0003_S10-0003_1.qgm	
5	Standard Sample	S10-0004	1 Standard	Met1.qgm	Untitled.qgm	5_S10-0004_1.qgm	0004_S10-0004_1.qgm	
6	Unknown Sample	UNK-0001	1 Unknown	Met1.qgm	Untitled.qgm	6_S10-0005_1.qgm	0005_S10-0005_1.qgm	

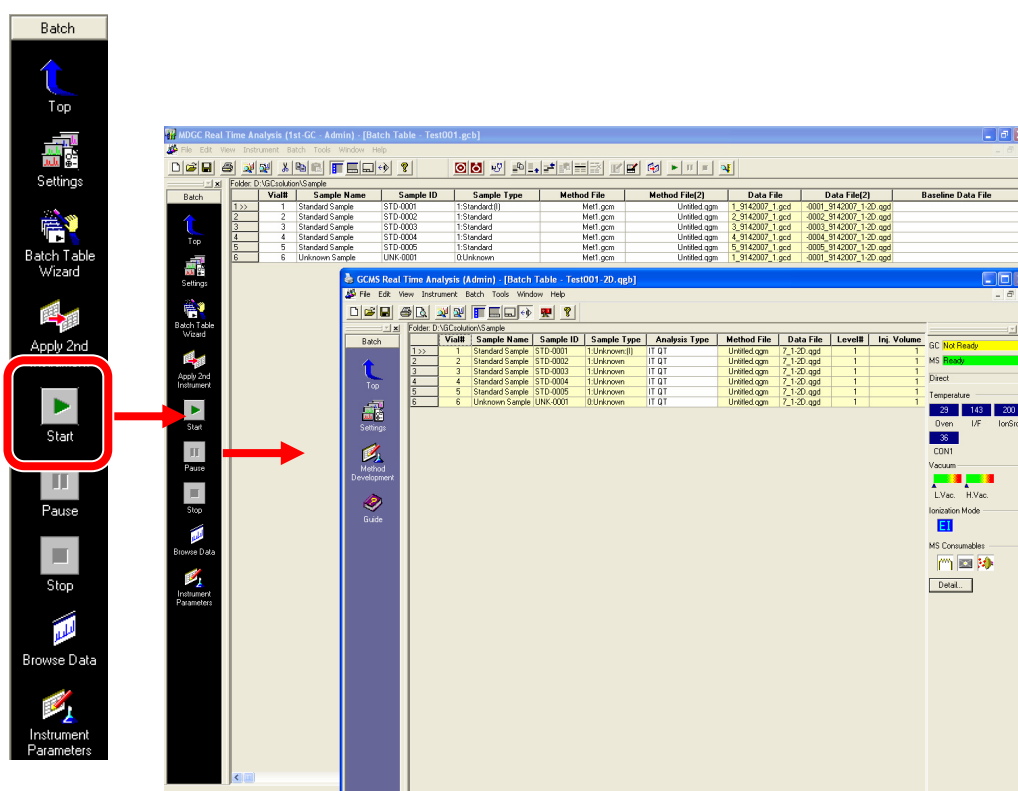
Created Batch Table

5.2 Starting Batch Analysis

When Batch Analysis is started in the [MDGC Real Time Analysis] window, the 2nd GCMS/GC batch file is automatically generated based on the Batch Table settings, and the 2nd GCMS/GC batch file name is saved appended with "-2D" in the same folder as the batch file in the [MDGC Real Time Analysis] window.

The [Method File], [Report File], [Sample Name], and [Sample ID] set in the Batch Table in the [MDGC Real Time Analysis] window are set as they are to the automatically generated 2nd GCMS/GC batch file. The 1st GC data file name appended with "-2D" is set as the data file name.

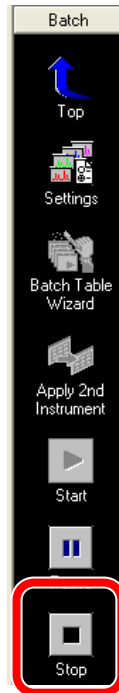
When the sample is injected, the temperature programs of the 1st GC and 2nd GCMS/GC column oven is started, data is acquired in the GCsolution or GCMSsolution [Real Time Analysis] window of each of the 1st GC and 2nd GCMS/GC, and saved in data files when analysis ends.



Starting Batch Analysis

5.3 Stopping Batch Analysis

Clicking the [Stop] icon on the assistant bar in the [MDGC Real Time Analysis] window stops Batch Analysis interlocked on both the 1st and 2nd sides.



MDGC Real Time Analysis [Batch] Assistant Bar



When stop batch analysis, it appears the message that current analysis is whether to continue or discontinue. If select continue, analysis of 2nd instrument is stopped in case the first batch analysis is finished



During analysis if an error occurred in 1stGC or 2nd instrument, both analysis will be stopped.

5.4 Batch Analysis Advanced Settings

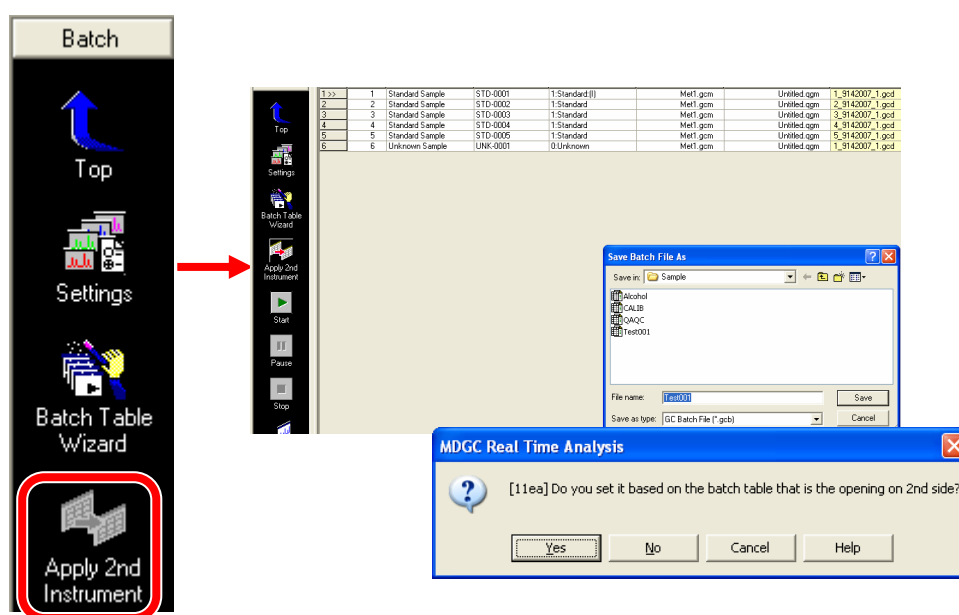
The following functions can be used in Batch Analysis in the [MDGC Real Time Analysis] window.

5.4.1 Using Items Not Set on 2nd Instrument GCMSsolution or GCsolution

When Batch Analysis is started, sample information (e.g. sample name and sample ID) and the 2nd instrument method file and report file are set to the 2nd instrument GCMSsolution or GCsolution Batch Table. However, setting items specific to GCMSsolution (e.g. auto-tuning and system check) are not set, and Batch Analysis is executed using the defaults for these settings.

To use these setting items when performing Batch Analysis, make the 2nd instrument GCMSsolution or GCsolution batch file and save this file beforehand, and start up this batch file from Batch Analysis in the [MDGC Real Time Analysis] window.

Clicking the [Apply 2nd Instrument] icon on the MDGCsolution [Batch] assistant bar makes the 2nd instrument GCsolution and GCMSsolution Batch Table based on the MDGC Real Time Analysis settings. The batch file name is automatically set.



Set the items to be executed to this Batch Table, and then save the settings. When Batch Analysis in the [MDGC Real Time Analysis] window is started, Batch Analysis is performed on the 2nd instrument based on the preset settings.

5.4.2 Pausing and Restarting Batch Analysis

Batch Analysis can be paused, rows added or deleted, and Batch Analysis restarted. When Batch Analysis is restarted, the 2nd instrument GCMSsolution or GCsolution Batch Table is automatically updated.

5.4.3 Using Batch Queue

The Batch Queue function can be used just as in GCMS/GCsolution.

5.4.4 Shutting Down at the End of Batch Analysis

This operation conserves carrier gas when Batch Analysis ends. Analysis conditions are downloaded to the instrument by setting a method file preset with a small total carrier gas flow rate to the final row of the Batch Table, and setting the vial number to "0". Analysis, however, is not performed.

Use of this function keeps consumption of carrier gas to a minimum even in cases where there is downtime between the end of Batch Analysis and the next analysis.



Caution When Setting a Short 1st GC Analysis Time

When an analysis in Batch Analysis ends, the settings of the next row in the Batch Table are downloaded to the instrument.

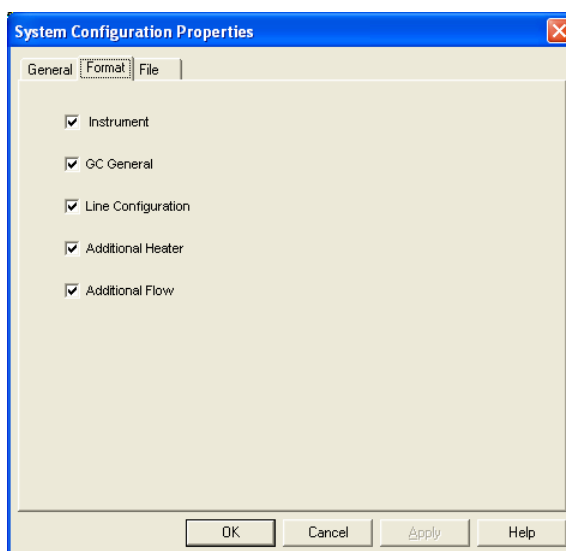
For this reason, when the 1st GC analysis time is short, and the method is switched to perform continuous analysis, the settings are changed while analysis is being performed on the 2nd instrument. In particular, when the pressure setting changes, a time range in which analysis is performed under conditions different from the preset analysis conditions is formed on the 2nd GCMS/GC. When changing the pressure, set the 1st GC analysis time so that it is longer than that of the 2nd instrument.

6. Printing MDGC Real Time Analysis Conditions

The type and format of reports that can be output on MDGCsolution are the same as those of the regular GCsolution. On the other hand, 2nd instrument GCMSsolution and GCsolution reports are made in the [Postrun] window of GCMSsolution and GCsolution that are controlling the 2nd instrument. The format, however, is the same as that of the regular GCMSsolution and GCsolution.

6.1 Printing System Configuration Items

Cryo trap on/off and APC for switching are printed to each of the line settings and additional flow items. The following shows an example of a printout.



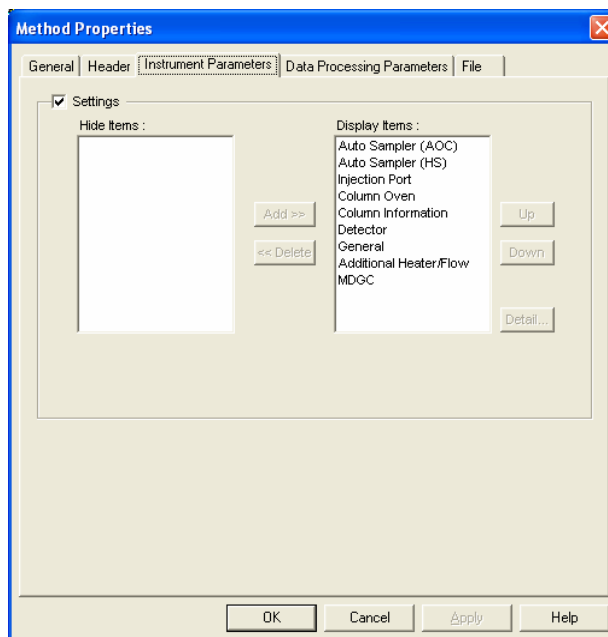
[System Configuration Properties] Window

Configuration			
[Line Setting]			
=Analysis Line1=			
	:		
	:		
	:		
<GCMS>			
Cryotrap	:No		
2ndColumnOutPressurize	:Yes	Port of APC	:APC1
[Additional Flow]			
Name	:APC1	Port	:APC1
Gas	:He	Slot	:SLOT3A
Control Mode	:Pressure	Use this device to switch	:Yes

Example of System Configuration Items Printout

6.2 Printing Methods

The switching program is printed by adding the [MDGC] item to [Display Items]. The following shows an example of a printout.



[Method File Properties] Window

Method		
<Analysis Line1>		
	:	
	:	
	:	
	:	
[MDGC]		
=Switching Program=		
Active	Start(min)	Stop(min)
1 [Yes]	0.029	0.089
2 [No]	0.181	0.881
3 [Yes]	5.000	5.800
4 [No]	7.000	8.000

Example of Method Printout

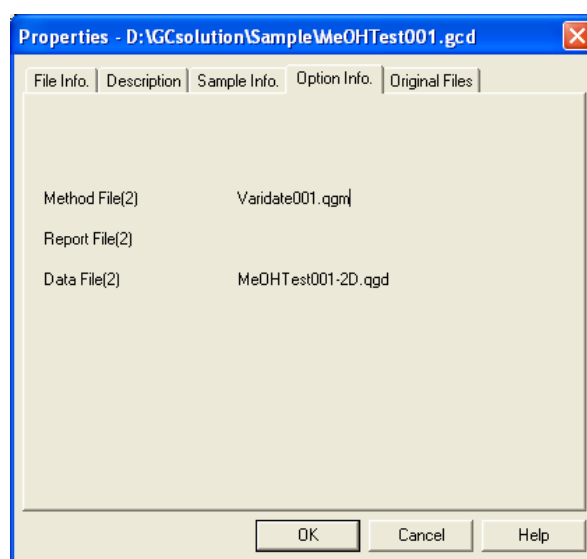
6.3 Printing Batch Tables

To print the settings of the 2nd side Batch Table, select [Option 3,4,5] at [Display Items] in the properties of the [Batch Table] item in the report, and set each [Option # Title] to [Method File (2)], [Report Format File (2)] and [Data File (2)].

7. Linking Analysis Conditions

7.1 Displaying 2nd Side Analysis Conditions

MDGCSolution is provided with a function for saving method file names, for example, used on the 2nd GCMS/GC to the 1st GC data file. To display this information, open the data file in the [GC Postrun] window, display the [Properties] window, and click the [Option Info.] tab.



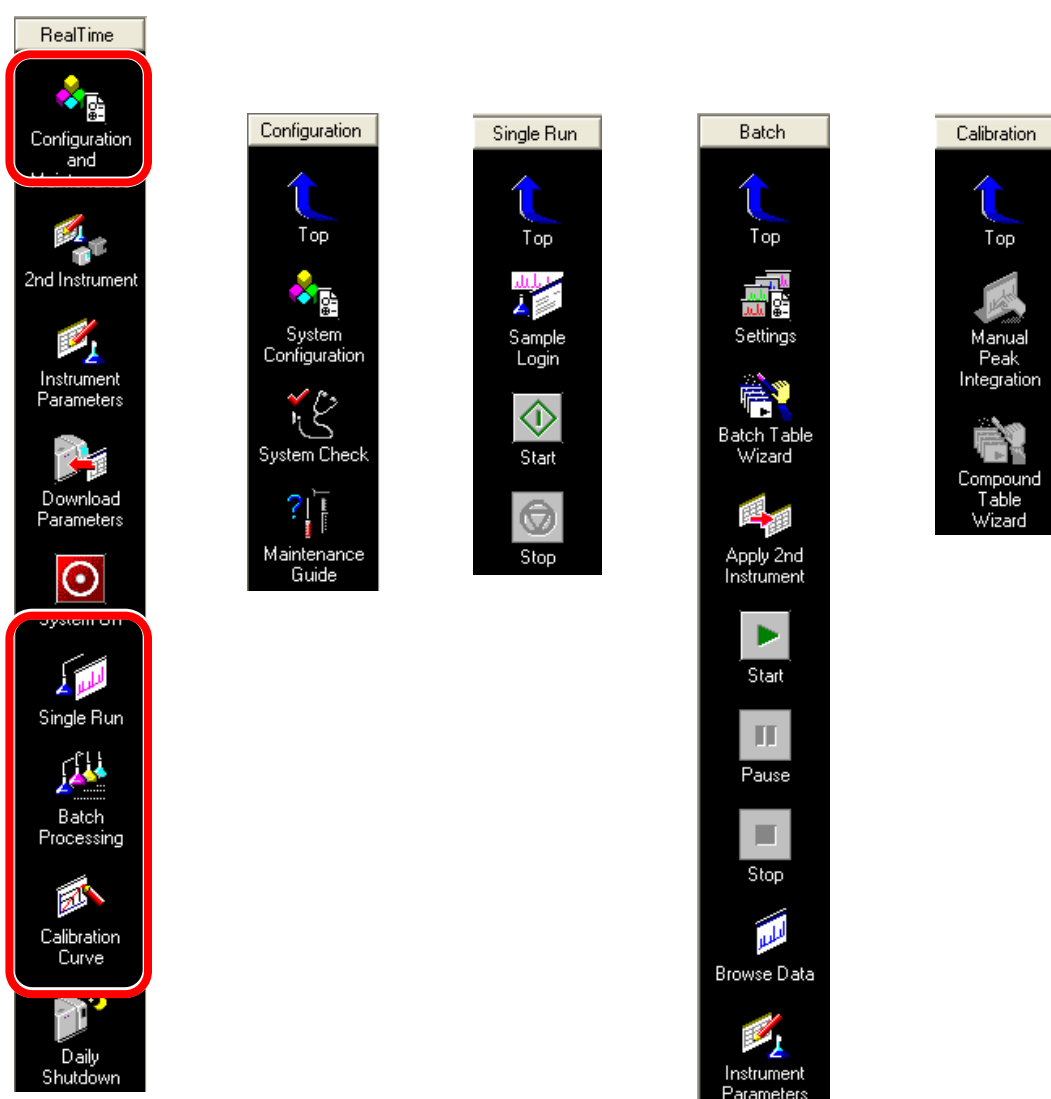
[Properties] Window

The 2nd GCMS/GC method file name, report format file name, and data file name are displayed as "Method File (2)", "Report Format File (2)" and "Data File (2)", respectively.

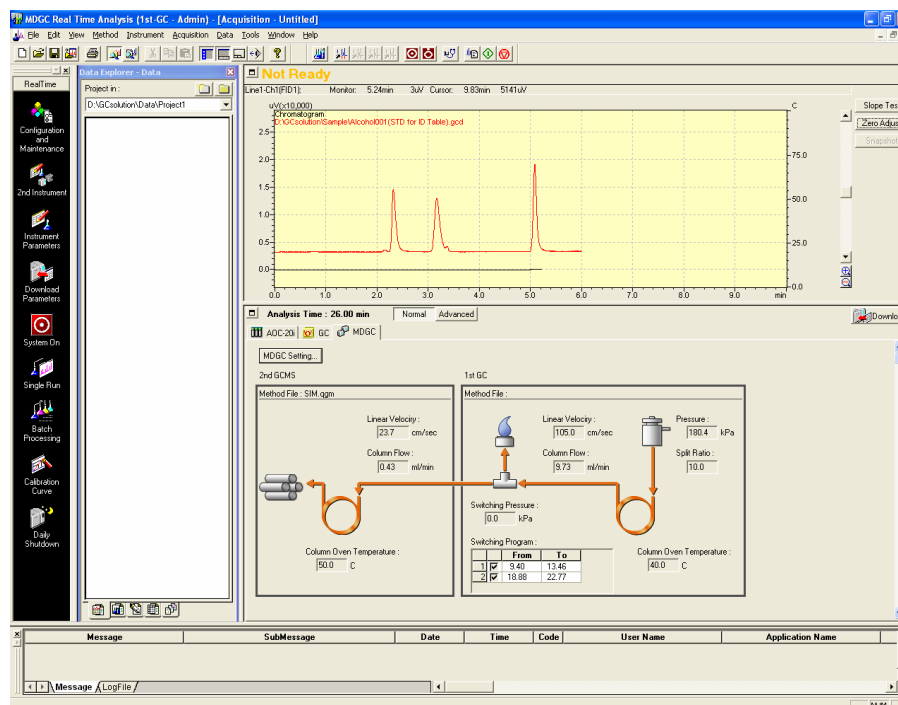
8. Reference

8.1 Assistant Bars

The following 5 assistant bars are provided in the [MDGC Real Time Analysis] window. The assistant bar titled [RealTime] on the left below is the top-level assistant bar. Lower-level assistant bars are displayed by clicking the respective icon. The top assistant bar [RealTime] is displayed again from a lower-level assistant bar by clicking the [Top] icon on the respective assistant bar.



8.2 Setting Ranges of Parameters Used in MDGC Real Time Analysis



[MDGC Real Time Analysis] Window

The upper half of the [MDGC Real Time Analysis] window is the chromatogram display area, and the lower half is the parameter setting area.

The menu in the lower half of the window can be switched by the following tabs.

The following tabs are displayed in the Normal mode.

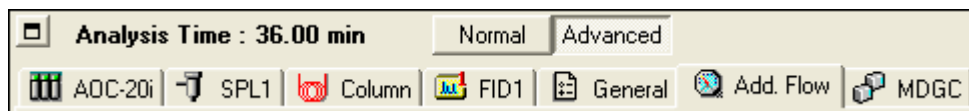


[AOC] tab page: This tab page is enabled when AOC20i autosampler is set at System Configuration.

[GC] tab page: This tab page is for making GC-related settings, such as column oven temperature and carrier gas pressure.

[MDGC] tab page: This tab page is for displaying the pressure settings of each component. The switching program can be set in this tab page.

The following tabs are displayed when [Advanced] is clicked to switch to the Advanced mode.



- | | |
|----------------------|---|
| [AOC] tab page: | This tab page is enabled when AOC20i autosampler is set at System Configuration. |
| [INJ] tab page: | This tab page is for setting the temperature and pressure of the injector. |
| [Column] tab page: | This tab page is for setting the column oven temperature program. |
| [DET] tab page: | This tab page is for making detector-related settings, such as detector temperature. |
| [General] tab page: | This tab page is for setting indirect conditions, such as the ready check and time program. |
| [Add.Flow] tab page: | This tab page is for setting the switching pressure. |
| [MDGC] tab page: | The functions of this tab page are the same as those on page 84. |

8.2.1 [AOC] Tab Page

☐ Analysis Time : 36.00 min Normal Advanced

AOC-20i GC MDGC

Injection Volume : μL (10.0 μL syringe)

of Rinses with Solvent(Pre-run) :

of Rinses with Solvent(Post-run) :

of Rinses with Sample :

Plunger Speed(Suction) : ☒ High ☐ Middle ☐ Low

Viscosity Comp. Time : sec

Plunger Speed(Injection) : ☒ High ☐ Middle ☐ Low

Syringe Insertion Speed : ☒ High ☐ Low

Injection Mode : Set... Advanced...

Parameter	Explanation	Setting Range (unit)	Default
Injection Volume	Sets the injection volume of the sample (amount sucked in by the syringe).		
	0.5 μL syringe Set this parameter in 0.01 units.	0.01 to 0.5 (μL)	0.05
	5 μL syringe Set this parameter in 0.1 units.	0.1 to 4.0 (μL)	0.5
	10 μL syringe Set this parameter in 0.1 units.	0.1 to 8.0 (μL)	1
	50 μL syringe Set this parameter in 0.5 units.	0.5 to 40.0 (μL)	5
	250 μL syringe Set this parameter in 2.5 units.	2.5 to 200.0 (μL)	25
# of Rinses with Solvent (Pre-run)	Sets the number of times that the syringe is rinsed with solvent before the sample is injected into the GC. This item is grayed out when [Injection Mode] is set to other than [Normal]. [# of Rinses with Solvent (Pre-run)] or [# of Rinses with Solvent (Post-run)] set in the [Injection Mode] window is used for the [# of Rinses with Solvent(Pre-run)] setting in the Solvent Flush mode.	0 to 99 (times)	0

8. Reference

Parameter	Explanation	Setting Range (unit)	Default
# of Rinses with Solvent (Post-run)	Sets the number of times that the syringe is rinsed with solvent after the sample is injected into the GC.	0 to 99 (times)	1
# of Rinses with Sample	Sets the number of times that the syringe is rinsed with the sample before the sample is injected into the GC. (With solvent flush injection, the syringe is not rinsed before injection.) Change the setting value, for example, when injecting different types of samples or injecting the same sample many times.	0 to 99 (times)	2
Plunger Speed (Suction)	Sets the suction speed of the plunger.	High Middle Low	High
Viscosity Comp. Time	Sets the wait time until the plunger starts lowering after the syringe has sucked in the sample. Though non-viscous liquids are sucked into the syringe at the same time that the plunger rises, highly viscous liquids are sucked in at a slower speed than the rise of the plunger. So, set a slightly longer wait time for highly viscous liquids.	0.0 to 99.9 (sec)	0.2
Plunger Speed (Injection)	Sets the injection speed of the plunger.	High Middle Low	High
Syringe Insertion Speed	Sets the insertion speed of the syringe.	High Low	High
Injection Mode [Set] button	Sets the sequence of the sample, solvent, and air, that are sucked in by the syringe. Clicking the [Set] button opens the [Injection Mode] window.	Normal Sample + Air + Solvent Sample + Solvent Sample + Air + Standard + Air + Solvent Sample + Standard + Solvent	Normal
[Advanced] Button	Opens the [Autosampler Advanced] window for making more detailed settings for autosampler operation.		

8.2.2 [GC] Tab Page

The [GC] tab page is displayed in the Normal mode. Setting parameters are filtered from the Advanced mode. For details on setting ranges, refer to the description in the Advanced mode.

Analysis Time : 36.00 min Normal Advanced

ADC-20i GC MDGC

Acquisition Time
 Detector : **FID1**
 Stop Time : **36.00** min
 (Link to Oven Program)

Temperature
 SPL1 : **250.0** C
 Column Oven : **40.0** C
FID1 : **250.0** C Detector Details...

Flow
 Carrier Gas Type : **He** Details...
 Injection Mode : **Split**
 Sampling Time : **1.00** min
 Pressure : **100.0** kPa
 Total Flow : **49.9** mL/min
 Column Flow : **4.26** mL/min
 Split Ratio : **10.0**

Program Type : **Column Temp.** Redraw

	Rate	Temperature	Hold Time
0	-	40.0	10.00
1	10.00	250.0	5.00
2	0.00	0.0	0.00

Total Program Time : 36.00 min

Column Information
 Name : **CBP1-S25-050** Set...
 Length : 25.0 m Inner Diameter : 0.32 mm ID

Graph: A temperature program graph showing temperature (C) vs. time (min). The temperature starts at 40.0 C, holds for 10.00 min, then ramps up to 250.0 C at 10.00 min, and holds for 5.00 min.

8.2.3 [MDGC] Tab Page

The [MDGC] tab page is for display of the MDGC system only. So, parameters and the switching program cannot be changed on this tab page.

Analysis Time : 26.00 min Normal Advanced

ADC-20i GC MDGC

MDGC Setting...

2nd GCMS
 Method File : **SIM.qgm**
 Linear Velocity : **23.7** cm/sec
 Column Flow : **0.43** mL/min
 Column Oven Temperature : **50.0** C

1st GC
 Method File :
 Linear Velocity : **105.0** cm/sec
 Column Flow : **9.73** mL/min
 Pressure : **180.4** kPa
 Split Ratio : **10.0**
 Switching Pressure : **0.0** kPa
 Switching Program :

	From	To
1	9.40	13.46
2	18.88	22.77

 Column Oven Temperature : **40.0** C

8.2.4 [INJ] Tab Page

Analysis Time : 36.00 min Normal Advanced

AOC-20i SPL1 Column FID1 General Add. Flow MDGC

Temperature : C kPa

Injection Mode : ▼

Sampling Time : min

Carrier Gas : He

Flow Control Mode : ▼

Pressure : kPa

Total Flow : mL/min

Column Flow : mL/min

Linear Velocity : cm/sec

Purge Flow : mL/min

Split Ratio :

INJ. Program ▼ Redraw

	Rate	Pressure	Hold Time
0	-	100.0	0.00
1	0.00	0.0	0.00
2	0.00	0.0	0.00

Total Program Time : 0.00 min Advanced...

Column Information (CBP1-S25-050)

Length : 25.0 m Film Thickness : 0.50 um

Inner Diameter : 0.32 mm ID

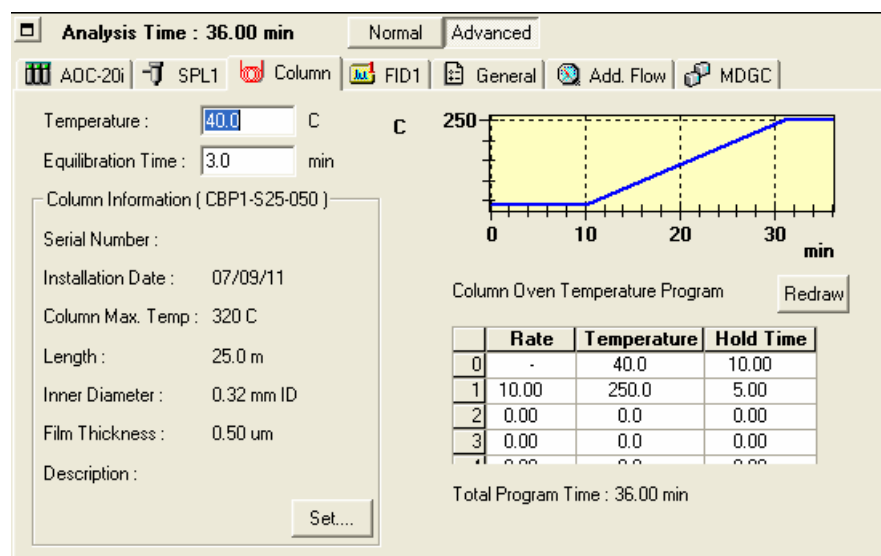
Parameter	Explanation	Setting Range (unit)	Default
Temperature	Sets the temperature of the injector.	-99.0 to 450.0 (°C)	25.0
Injection Mode	Click [▼] on the right, and select the injection mode from the list that is displayed. This item is not displayed in the case of the WBI (OCI).	Split Splitless Direct	Split
Sampling Time	Sets the sampling time. The sampling time is the time from injection of the sample up to opening of the split route. This item is enabled only when [Injection Mode] is set to Splitless. This item is not displayed in the case of the WBI (OCI).	0.00 to 9999.99 (min)	1.00
Carrier Gas	This groups carrier gas-related setting items. Each of the [Carrier Gas] parameters is related to each other. When one of the setting values is changed, the setting values of the other parameters are automatically		

Parameter	Explanation	Setting Range (unit)	Default
	changed according to a calculation formula. Note, however, that the value of the parameter currently set at [Flow Control Mode] is not changed.		
Flow Control Mode	Only the Pressure mode is supported on MDGCsolution.	Pressure	Pressure
Pressure	Sets the column inlet pressure.	0.0 to 970.0 (kPa)	100.0
Total Flow	Sets the total flow rate. This item cannot be set when [Injection Mode] is set to [Direct] on an SPL (PTV) and in the case of the WBI (OCI).	0.0 to 1200.0 (mL/min)	50.0
Column Flow	Sets the column flow rate.	Calculated value	
Linear Velocity	Sets the linear velocity of the carrier gas.	Calculated value	
Purge Flow	Sets the purge flow rate.	0.0 to 1200.0 (mL/min)	3.0
Split Ratio	Sets the split ratio 1:X (Column Flow : Split Flow). This item cannot be set when [Injection Mode] is set to [Direct] on an SPL (PTV) and in the case of the WBI (OCI). When the setting value is "-1" and [Column Flow] or other parameters are changed, other parameters are calculated with priority given to the setting value of [Total Flow].	-1, 0.0 to 9999.9	-1
INJ. Program	The injector control program can be set here. Click [▼] on the right, and select which control program is to be set from the list that is displayed. The temperature program can be set when the injector type is a PTV or OCI, and the heater port is INJ2.	Temperature Flow Pressure Purge Flow	
Programming Area	This area is for setting the control program set at [INJ.Program].		
Graph area [Redraw] button	Clicking this button redraws the program made in the programming area in the graph area.		
Total Program Time	Displays the total time of the injection program.		
CRG	Not available		

8. Reference

Parameter	Explanation	Setting Range (unit)	Default
Column Information	Displays part of the column information ([Length], [Inner Diameter] and [Film Thickness]) currently selected on the [Column] tab page at [System Configuration] - [Analytical Line].		
[Advanced] button	Displays [Injection Port Advanced].		
Temperature program	Rate	-400.0 to 400.0 (°C/min)	0.00
	Temperature	-99.0 to 450.0 (°C)	0.0
	Hold Time	0.00 to 9999.99 (min) 0.00	0.00
Pressure program	Rate	-400.00 to 400.00 (kPa/min)	0.00
	Pressure When the primary pressure is 980 kPa When the primary pressure is 400 kPa or 600 kPa	0.0 to 970.0 (kPa) 0.0 to 400.0 (kPa)	0.0
	Hold Time	0.00 to 9999.99 (min) 0.00	0.00
Purge flow program	Rate	-400.0 to 400.0 (°C /min)	0.00
	Flow	0.0 to 1200.0 (mL/min)	0.0
	Hold Time	0.00 to 9999.99 (min)	0.00

8.2.5 [Column] Tab Page



Parameter	Explanation	Setting Range (unit)	Default
Temperature	Sets the temperature of the column oven.	-99.0 to 450.0 (°C)	25.0
Equilibration Time	Sets the equilibration time up to when the system changes state to Ready after all items selected at [Ready Check] on the [General] tab page have reached their set values.	0.0 to 9999.9 (min)	3.0
Column Information	Displays the column information currently selected on the [Column] tab page at [System Configuration] - [Analytical Line].		
Column Oven Temperature Program	Rate	-250.0 to 250.0 (°C /min)	0.0
	Temperature	-99.0 to 450.0 (°C)	0.0
	Hold Time	0.00 to 9999.99 (min)	0.00
	Graph area [Redraw] button	Clicking this button redraws the column oven temperature program made in the programming area in the graph area.	
	Total Program Time	Displays the total time of the column oven temperature program.	
CRG	Not available		
[Set] button	Displays the [Column] tab for [Analytical Line] modules.		

8.2.6 [DET] Tab Page

Analysis Time : 36.00 min Normal Advanced

AOC-20i SPL1 Column FID1 General Add. Flow MDGC

Temperature : 250.0 C

☒ Signal Acquire

Sampling Rate : 40 msec

Stop Time : 36.00 min
(Link to Oven Program)

Delay Time : 0.00 min

Subtract Detector : None

mL/min

50

0

0 25 50 75 min

Flow Program Makeup Redraw

	Rate	Flow	Hold Time
0	-	30.0	0.00
1	0.00	0.0	0.00
2	0.00	0.0	0.00

Total Program Time : 0.00 min

Makeup Gas : He H2 Flow : 40.0 mL/min

Makeup Flow : 30.0 mL/min Air Flow : 400.0 mL/min

Parameter	Explanation	Setting Range (unit)	Default
Temperature	Sets the temperature of the detector.	0.0 to 450.0 (°C) (FID/FPD) 0.0 to 450.0 (°C) (FTD) 0.0 to 350.0 (°C) (ECD) 0.0 to 400.0 (°C) (TCD)	25.0
Signal Acquire	Selecting this checkbox executes data (signal) acquisition according to the following parameter settings. When this checkbox is deselected, data (signal) acquisition is not performed.	Selected/Not selected	Selected
Sampling Rate	When base rate is 4 to 80 (msec) When base rate is 100 or more (msec)	1 to 20X the base rate 1 to 10X the base rate	Base rate
Stop Time	Sets the time that data acquisition is stopped.	0.00 to 9999.99 (min)	60

Parameter	Explanation	Setting Range (unit)	Default
Subtract Detector	When this parameter is set, the difference signal between the signal of the specified detector becomes the chromatogram data.	None / DET#1 to DET#4 (The detector currently selected at [System Configuration] - [Analytical Line] is displayed.)	None
Delay Time	Sets the data acquisition delay time from start of the GC instrument program up to start of data acquisition. Set a value smaller than the stop time.	0.00 to 9999.99 (min)	0.00
Makeup Flow (FID/FPD/FTD/ECD/TCD)	Sets the makeup gas flow rate as a flow rate value or pressure value.	0.0 to 1200.0 (mL/min)	30 (FID) 27.5 (FTD) 30 (ECD) 8 (TCD)
H2 Flow (FID/FPD/FTD)	Sets the hydrogen flow rate as a flow rate value or pressure value.	0.0 to 1200.0 (mL/min)	40 (FID) 80 (FPD) 1.5 (FTD)
Air Flow (FID/FPD/FTD)	Sets the air flow rate as a flow rate value or pressure value.	0.0 to 1200.0 (mL/min)	400 (FID) 120 (FPD) 145 (FTD)
Flow Program (FID/FPD/FTD)	The makeup gas, hydrogen and air flow rate/pressure programs can be set here.	0 to 7th row	
	Rate	-400.00 to 400.00 (mL/min ²)	0.00
	Flow	0.0 to 1200.0 (mL/min)	0.0
	Hold Time	0.00 to 9999.99 (min)	0.00
Current (FID/FPD/FTD/ECD/TCD)	Sets the current value of the detector.	0.00 to 50.00 (pA) (FTD) 0.00 to 2.00 (nA) (ECD) 0.00 to 100.00 (mA) (TCD)	0.00 (FTD) 0.00 (ECD) 0.00 (TCD)
Voltage (FTD)	Sets the voltage value of the detector.	0 to 100 (%)	0
Polarity (TCD)	Sets the polarity of the detector.	+, -	+
[Redraw] button	Redraws the graph.		
Total Program Time	Displays the total time of the flow program.		

8.2.7 [General] Tab Page

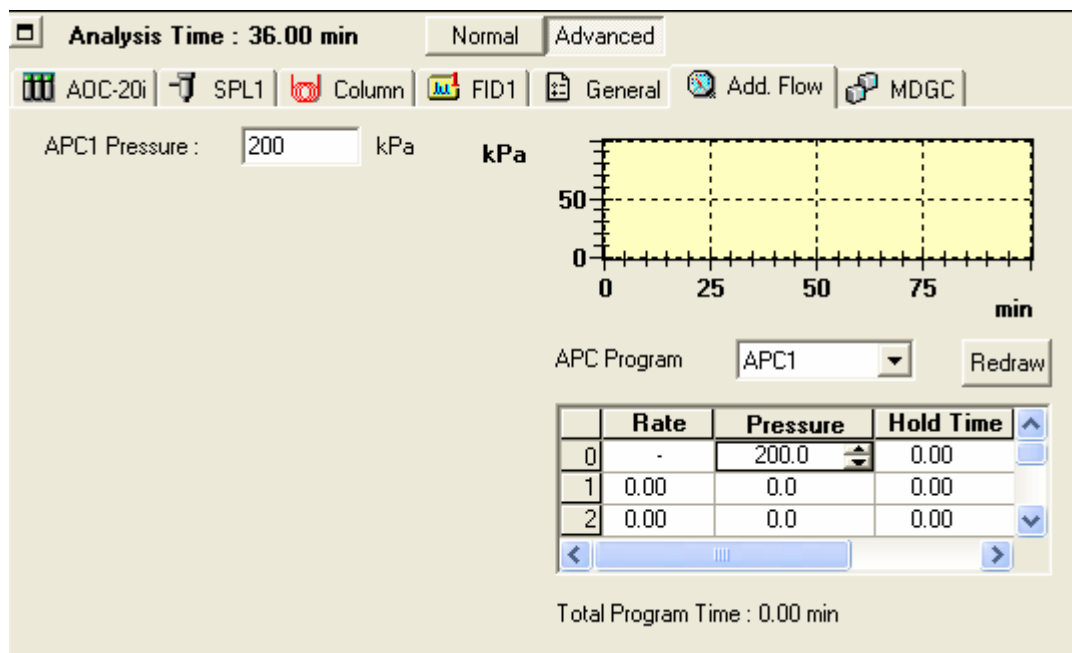
Parameter	Explanation	Setting Range (unit)	Default
Ready Check	<p>When the actual measured value of items selected at these checkboxes reach the setting value, [GC Status] changes to Ready.</p> <ul style="list-style-type: none"> Heat Unit Detector(FTD) Baseline Drift Injection Flow Add. Flow Detector APC Flow External Wait <p>The [Name] set in the properties of the module set at [Configured Modules] in [System Configuration] is displayed at [Ready Check].</p>	Selected/Not selected	Selected
Prerun Program	The time program for controlling each module before analysis comprising up to 100 steps can be set here.		
Time	Click the desired cell and set the event generation time for each instrument either by clicking [▲] or [▼] that is displayed on the right or by entering a value directly. Do not set the same time in 4 or more rows. The event does not occur if the same time is set in 4 or more rows.	0.00 to 9999.00 (min)	0.00

Parameter	Explanation	Setting Range (unit)	Default
Device	Select the desired cell, click [▲] that is displayed on the right, and select the module to be used from the list that is displayed. Of the modules set at [Configured Modules] in [System Configuration], those that can be used in the program are displayed in this list.		
Event	Select the desired cell, click [▲] that is displayed on the right, and select the event to be used from the list that is displayed. Events that can be used on the module set at [Device] are displayed in this list.		
Value	Set values for events that require parameter settings here.		
Total Program Time	Displays the total time of the prerun program.		
Time Program	The time program for controlling each module during analysis comprising up to 100 steps can be set here.		
Time	Click the desired cell and set the event generation time for each instrument either by clicking [▲] or [▼] that is displayed on the right or by entering a value directly. Do not set the same time in 4 or more rows. The event does not occur if the same time is set in 4 or more rows.	0.00 to 9999.00 (min)	0.00
Device	Select the desired cell, click [▲] that is displayed on the right, and select the module to be used from the list that is displayed. Of the modules set at [Configured Modules] in [System Configuration], those that can be used in the program are displayed in this list.		
Event	Select the desired cell, click [▲] that is displayed on the right, and select the event to be used from the list that is displayed. Events that can be used on the module set at [Device] are displayed in this list.		
Value	Set values for events that require parameter settings here.		

8. Reference

Parameter	Explanation	Setting Range (unit)	Default
Total Program Time	Displays the total time of the time program.		
Auto	This area is for making detector ignition-related settings. <ul style="list-style-type: none">•Auto Flame On•Auto Flame Off•Reignite This item is enabled only for FID and FPD. Note, however, this it is enabled when an APC is mounted. The [Auto Flame Off] checkbox is always selected.	Selected/Not selected	Not selected
Auto Zero after Ready	When this checkbox is selected, zero offset is automatically performed when the instrument changes state to ready.	Selected/Not selected	Selected

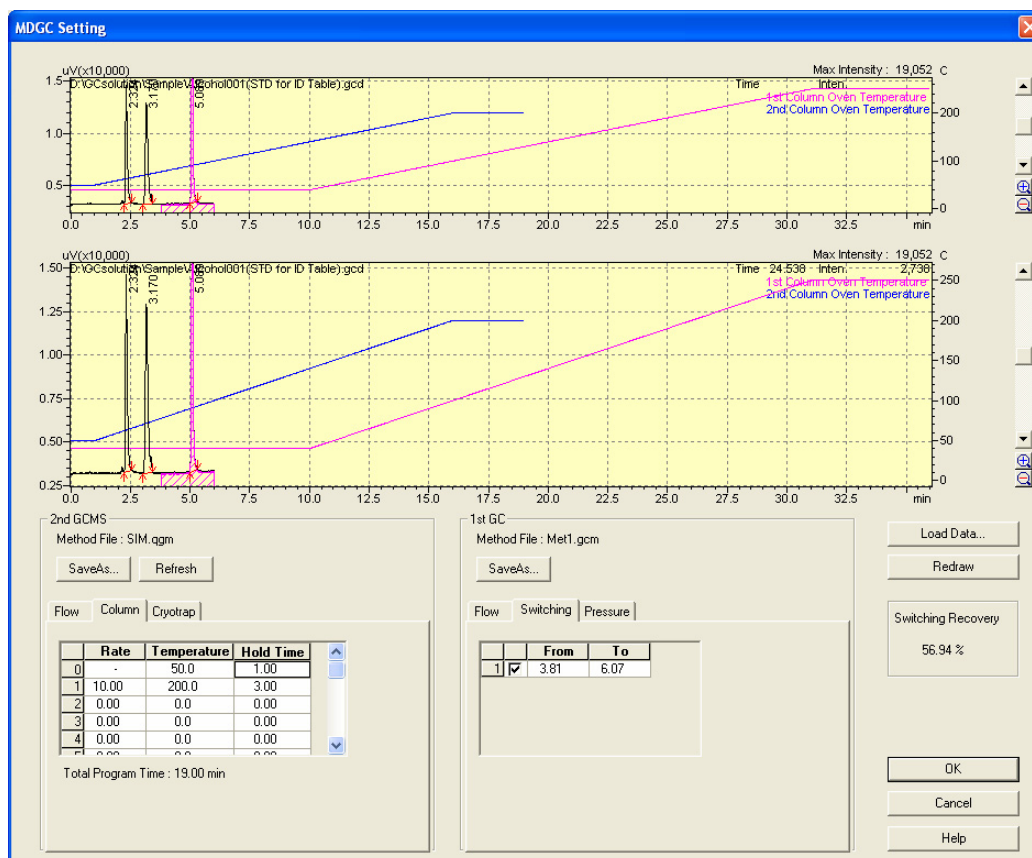
8.2.8 [Add.Flow] Tab Page



Parameter	Explanation	Setting Range (unit)	Default
Pressure	Sets the pressure of each additional flow module.	0.00 to 970.0 (kPa)	0.0
Flow	Sets the flow rate of each additional flow module.	0.0 to 1200.0 (mL/min)	0.0
APC Program	The following control program can be set to each flow module here.		
Pressure	Rate	-400.0 to 400.0 (kPa/min)	0.00
	Pressure	0.0 to 970.0 (kPa)	0.0
	Hold Time	0.00 to 9999.99 (min)	0.00
Flow	Rate	-400.0 to 400.0 (mL/min ²)	0.00
	Flow	0.0 to 1200.0 (mL/min)	0.0
	Hold Time	0.00 to 9999.99 (min)	0.00

8.3 Setting Ranges of Parameters Used in the [MDGC Setting] Window

To open the [MDGC Setting] window, click the [MDGC Setting] button in the [MDGC Real Time Analysis] window.



[MDGC Setting] Window

The upper half of the [MDGC Setting] window is the chromatogram display area for the switching settings, and the lower half is the analysis conditions setting area. The left side of the lower half is the 2nd GCMS/GC setting area, and the right side is the 1st GC setting area. The items in each of these setting areas can be switched by tabs.

8.3.1 2nd GCMS/GC

The following 3 tab menus are provided in the 2nd GCMS/GC setting area displayed on the left side:



- [Flow] tab
[Linear Velocity], [Column Flow], and [Column Outlet Pressure] can be displayed and set on this tab page.

Item	Setting Range
Linear Velocity	Calculated value
Column Flow	Calculated value
Column Outlet Pressure	0.00 to 970 (kPa)

- [Column] tab
The column oven temperature program can be displayed and set on this tab page.

	Rate	Temperature	Hold Time
0	-	50.0	1.00
1	10.00	200.0	3.00
2	0.00	0.0	0.00
3	0.00	0.0	0.00
4	0.00	0.0	0.00
5	0.00	0.0	0.00

Total Program Time : 19.00 min

Item	Setting Range
Rate	-250 to 250 (°C/min)
Temperature	-99 to 450 °C
Hold Time	0.00 to 9999.99 (min)

- [Cryotrap] tab
The cryo trap control program can be displayed and set on this tab page.

	Time	ON/OFF
1	1.00	ON
2	2.00	OFF
3	0.00	OFF
4	0.00	OFF
5	0.00	OFF
6	0.00	OFF

Item	Setting Range
Time	0.00 to 9999.99 (min)
ON/OFF	ON/OFF

8.3.2 1st GC

The following 3 tab menus are provided in the 1st GC setting area displayed on the right side:



- [Flow] tab

Parameters, such as [Linear Velocity] and [Column Flow], can be displayed and set.

[Column Information] can be only displayed.

Item	Setting Range
Linear Velocity	Calculated value
Column Flow	Calculated value
Split Ratio	-1, 0.0 to 9999.9
Switching Pressure	0.00 to 970 (kPa)

- [Switching] tab

The switching program can be displayed and set on this tab page.

Item	Setting Range
<input type="checkbox"/>	Selected/Not selected
From	0.00 to 9999.99 (min)
To	0.00 to 9999.99 (min)

- [Pressure] tab

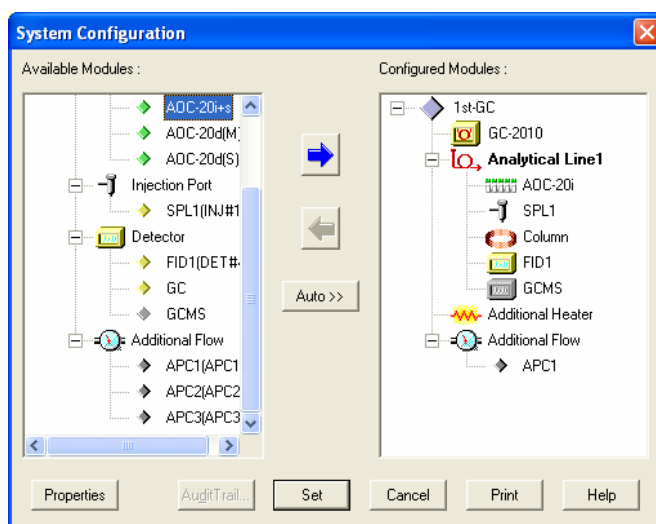
The pressure and pressure program can be displayed and set on this tab page.

Item	Setting Range
Rate	-250 to 250 (°C/min)
Pressure	-99 to 450 °C
Hold Time	0.00 to 9999.99 (min)

8.4 System Configuration Setting Items

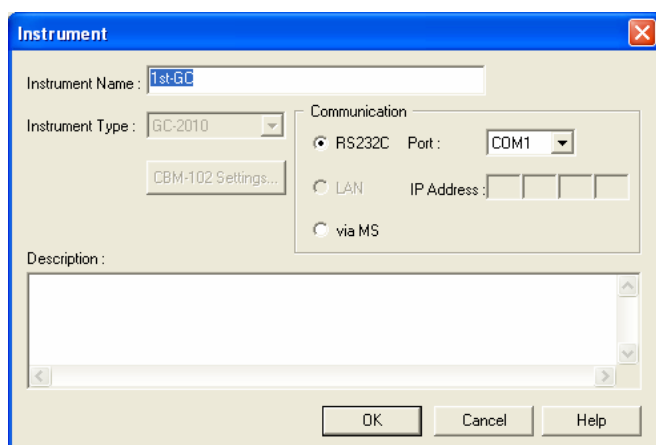
In the System Configuration, some of the functions specific to MDGCsolution are expanded and limited.

8.4.1 Configured Modules



Item	Setting Range
Configured Modules	Available Modules

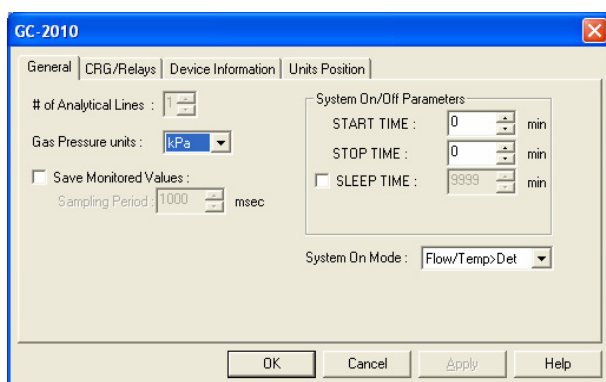
8.4.2 Instrument



Item	Setting Range
Instrument Name	Can be changed.
Instrument Type	GC-2010 (fixed)
Communication	Can be selected.
Description	Can be entered.

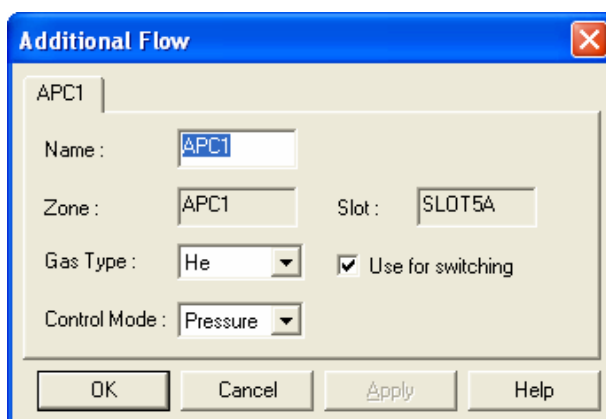
8. Reference

8.4.3 GC-2010



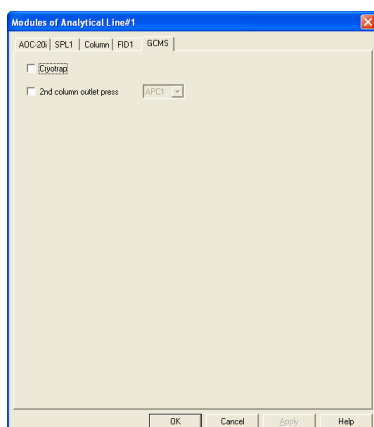
Item	Setting Range
# of Analytical Lines	1 (fixed)
Gas Pressure units	kPa, psi
Save Monitored Values	Selected/Not selected
Atmospheric Pressure Compensation	Selected/Not selected

8.4.4 Additional Flow



Item	Setting Range
Name	Can be changed.
Zone	Displayed only
Slot	Displayed only
Gas Type	He/N2
Control Mode	Pressure/Flow
Use for switching	Selected/Not selected

8.4.5 Modules of Analytical Line#1



Item	Setting Range
Cryotrap	Selected/Not selected
2nd column outlet press	Selected/Not selected Name of used APC

8.5 Files Used in MDGCsolution

The following files are handled in MDGCsolution.

8.5.1 Method Files

The method file used on the 1st side contains some of the 2nd instrument settings made at System Configuration. Also, switching programs are saved separately from time programs.

8.5.2 Data Files

The data file made by acquiring data on the 1st side contains the 2nd instrument settings made at System Configuration. Also, the switching program is included as part of the method.

8.5.3 Batch Files

The 1st side Batch Table includes the method file name, report file name and data file name that are used in 2nd side Real Time Analysis. Since Options 3, 4 and 5 are used, the file format is exactly the same as the regular file format.

8.5.4 Report Format Files

Exactly the same files as those in GCMS/GCsolution are used.

8.5.5 System Configuration Files

The 1st side system configuration settings contain some of the settings of the 2nd instrument.

8.5.6 Log Files

Exactly the same files as those in GCMS/GCsolution are used.

8.5.7 Template Files

Template files are the same as batch files.

8.5.8 User Administration Files

Exactly the same files as those in GCMS/GCsolution are used.

9.Using GC and GCMS as a Standalone GC and GCMS

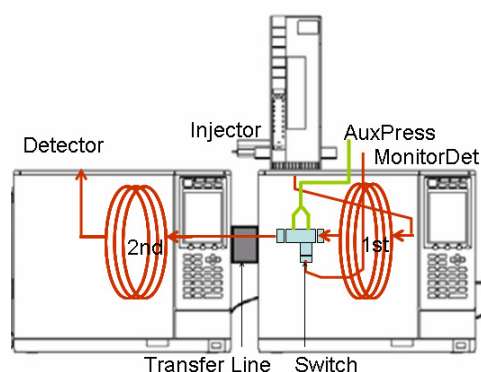
In an MDGC system, the 1st GC and 2nd GC/GCMS are in a connected configuration. However, they can each be used as a standalone GC and GCMS by changing the internal column connection.

This section describes how to use an MDGC system as a standalone GC and GCMS.

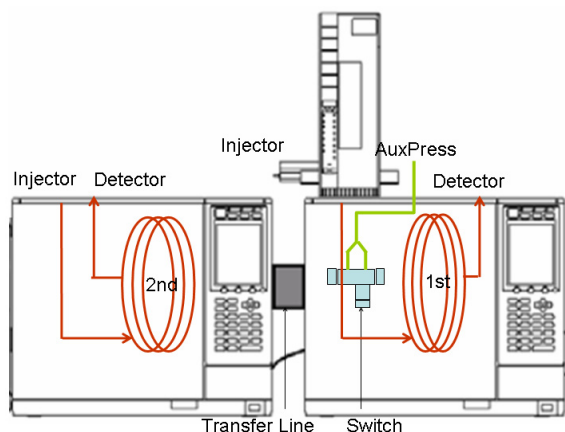
1. Disconnect the columns from the MDGC switching device, and connect the columns to the injector and detector for the regular GC and GCMS.
2. Start up GCsolution or GCMSsolution.

9.1 Changing the Column Connection

The 1st GC and 2nd GCMS/GC columns in the MDGC system are connected as shown below.



Re-connect the columns as shown below.



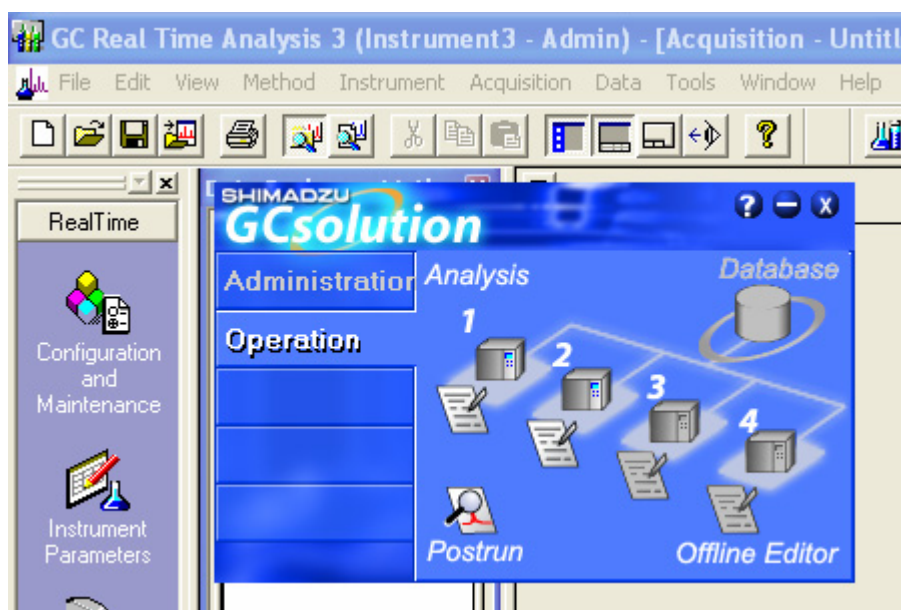
9.2 Starting Up GCsolution and GCMSsolution

Click the Desktop icon or the Windows [Start] menu to open the menu, and click the [GCsolution] or [GCMSsolution] icon under [Program] that is displayed to start up the regular GCsolution or GCMSsolution.

9.2.1 Number of Connectable Instruments

In GCsolution, two GCs can be controlled.

When GCsolution is started up, only Analysis 1 and Analysis 2 can be clicked on the Launcher. This is because MDGCsolution occupies two instruments. MDGCsolution uses Analysis 1 and Analysis 2. So, the [GC Real Time Analysis 3] window opens when Analysis 1 is selected on the Launcher. Likewise, the [GC Real Time Analysis 4] window opens when Analysis 2 is selected.



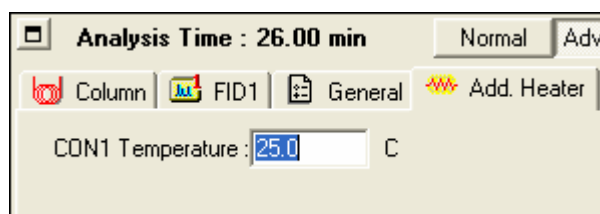
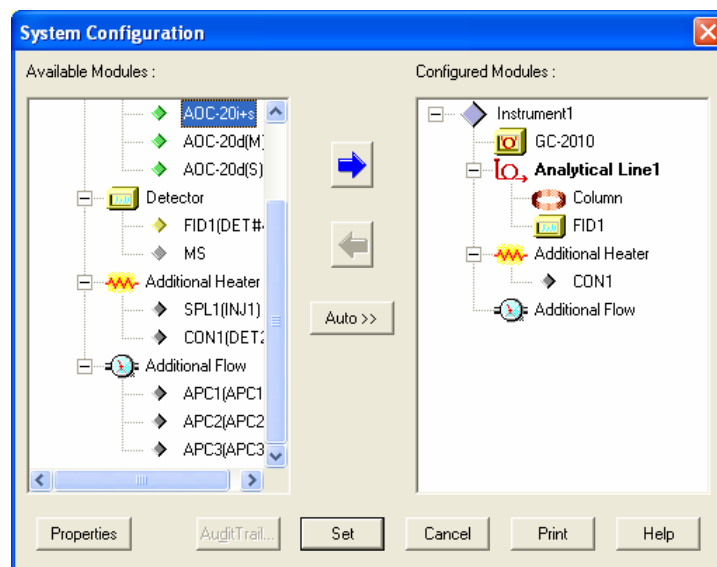
The [GC Real Time Analysis 3] Window Opens when Analysis 1 Is Selected

On the other hand, since only one GCMS can originally be controlled on GCMSsolution, functions are not limited even when the GCMS is used as a standalone GCMS. GCMS starts up as instrument 1 when it is started up from MDGCsolution, and as instrument 2 when it is started up from the Desktop icon or from the Windows [Start] menu. So, the system configuration that was set during use of MDGC is not inherited.

9.2.2 Caution When Setting Methods

When the GC/GCMS is used as a standalone unit, the interface heater between the 1st GC and the 2nd instrument cannot be used.

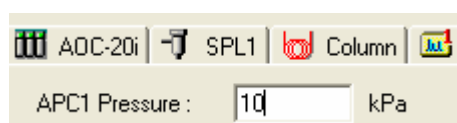
So, either disconnect the additional heater from the 2nd instrument system configuration, or change the temperature in the method to within 30 to 40°C.



Interface Heater Setting

9.2.3 Handling the Switching Device

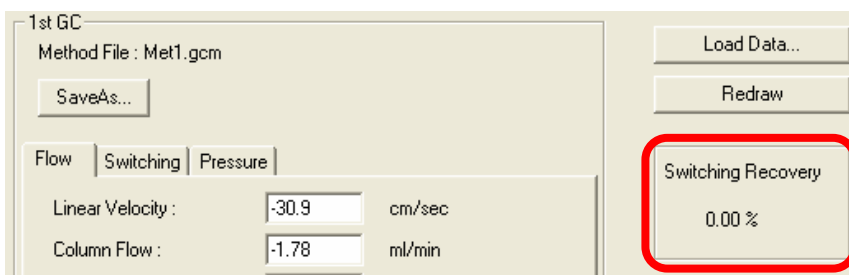
When the GC/GCMS is used as a standalone unit, the switching device is not used. However, do not stop the gas since the column oven temperature is raised during analysis. For this reason, add the APC for switching to [Configured Modules] in the 1st GC side system configuration. Next, set a lower APC pressure (approx. 10 kPa) in the method to prevent deterioration of the non-activated surface inside the switching device since carrier gas flows at all times.



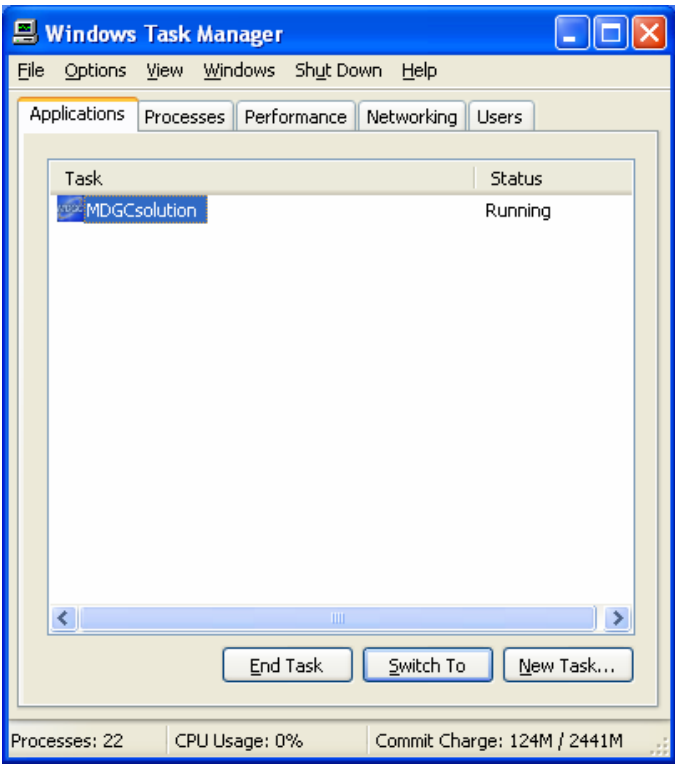
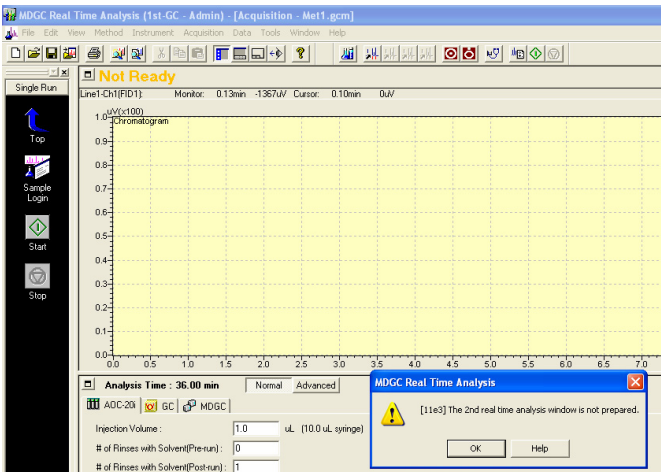
Setting the APC for Switching

10. Troubleshooting

10.1 Analysis-related Troubleshooting

Trouble	Cause and Remedy
Peak is not detected.	<p>Probable causes include little pressure difference or 0 recovery. Change the pressure conditions so that the recovery is increased.</p>  <p>The screenshot shows the '1st GC' software interface. The 'Method File' is 'Met1.gcm'. There are buttons for 'SaveAs...', 'Load Data...', and 'Redraw'. The 'Switching' tab is selected, showing 'Linear Velocity' at -30.9 cm/sec and 'Column Flow' at -1.78 ml/min. The 'Switching Recovery' is 0.00%, which is highlighted with a red rectangle.</p>
Broad peaks	<p>A probable cause is that there is insufficient pressure difference between the pressure and the switching pressure. Change the pressure conditions.</p>
FID flame is extinguished.	<p>A probable cause is that the switching pressure is too high. Change the pressure conditions.</p>

10.2 Software-related Troubleshooting

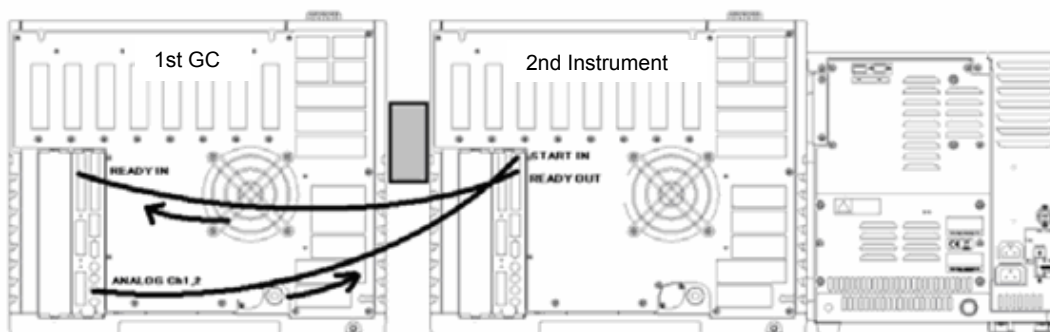
Trouble	Cause and Remedy
Software does not start up.	A probable cause is an unstable PC. Restart the PC and then retry starting up the software.
Analysis does not start.	Make sure that the cable connections are correct.
Software does not exit.	<p>Forcibly exit the software by Alt+Ctrl+Del.</p>  <p>The screenshot shows the Windows Task Manager window with the 'Applications' tab selected. A single task, 'MDGCsolution', is listed with a status of 'Running'. The task bar at the bottom shows 'Processes: 22', 'CPU Usage: 0%', and 'Commit Charge: 124M / 2441M'.</p>
Data is not staved.	<p>Make sure that the 2nd instrument has started up.</p>  <p>The screenshot shows the MDGC Real Time Analysis software interface. The status bar at the top indicates 'Not Ready'. The main display area shows a chromatogram plot. A small error dialog box is visible in the bottom right corner, stating: 'MDGC Real Time Analysis [11e3] The 2nd real time analysis window is not prepared.' The dialog has 'OK' and 'Help' buttons.</p>

11. Appendix Installing the System

11.1 Wiring

Connect the 1st GC and 2nd GCMS/GC using the 2 cables provided with the interface heater ASSY (P/N: 221-72487-34).

- START CABLE (P/N: 221-71509-91)**
 This cable is for starting analysis on the 2nd GCMS/GC at the same time that analysis on the 1st GC is started.
 Connect this cable between the Analog Ch 1, 2 on the 1st GC and the Start In terminal on the 2nd GCMS/GC.
- READY cable (P/N: 221-72485-91)**
 This cable is for receiving on the 1st GC whether or not the 2nd side is ready. The 2nd GCMS/GC ready status can be checked by connecting this cable and selecting the [External Wait] checkbox in the [Ready Check] field for the 1st GC method.
 Connect this cable between the Ready In terminal on the 1st GC and the Ready Out terminal on the 2nd GCMS/GC.



Connecting the START CABLE and READY CABLE

11.2 Installing the Software



When re-installing the software for some reason (e.g. something has prevented correct operation of MDGCsolution), first uninstall the MDGCsolution software.



The Install Disk is provided as a CD-ROM.

When the MDGCsolution install program is executed, the exclusive program on the disk automatically decompresses and copies the program to hard disk on the PC.



To install this software, Windows 2000 Professional or Windows XP Professional must be installed as the operating system on the PC.



This software can be installed by users with Windows administrator rights.

When setting up the MDGC system, first install GCMSsolution if the 2nd instrument is a GCMS.

Perform a standard installation for GCsolution regardless of the 2nd instrument, and then install GCsolution for four GCs.

Install MDGCsolution after completing the above GCsolution/GCMSsolution installation procedure.

1. Install GC/GCMSsolution by the regular procedure, and then insert the install disk in the CD-ROM drive. [MDGCsolution Setup] starts up automatically.
2. The [Welcome] window opens.
3. The [Type of 2nd instrument] window opens. Select the [GC] or [GCMS] radio button, and click [Next].



When the 2nd Instrument is GCMS after installing MDGCsolution please start GCMSsolution from the desktop icons once



To work MDGCsolution, GCsolution is Ver.2.30SU7 later, GCMSsolution, Ver2.50Su4 subsequent version is required. GCMSsolution of Ver2.50Su4 is included in MDGCsolution installation disk

11.3 Uninstalling the Software

1. Move the mouse pointer to [Settings] in the Windows [Start] menu, and click [Control Panel].
2. Double-click the [Add/Remove Programs] icon.
3. Select "MDGCsolution" and click [Remove].