

## Process Gas Chromatograph

# GC1000 *Mark II*

The GC1000 Mark II offers two new process gas chromatographs: the Isothermal Oven type which sets new standards for easy operation and reliable performance; and the Programmed-Temperature Oven type which has the same easy operation plus features optimized for capillary column applications.



# Our Advanced New Process Gas Chromatograph Gives you All You Expected ... And Even More

## Vast Experience and Original Technology

It is now more than 30 years since Yokogawa shipped its first process gas chromatograph. During those three decades, we've put more than 5,000 units into operation. As Japan's leading manufacturer of process gas chromatographs, Yokogawa has always offered its customers the most advanced gas chromatograph technology available.

## New Gas Chromatograph Responds to Today's Needs

With today's relentless emphasis on cost reduction, managers are demanding ever-tighter quality control in process operations. Together with the trends toward stricter environmental protection and the development of new product materials, this is creating the need for new capabilities in process gas chromatographs. The new GC1000 has been developed to respond to those needs, drawing on Yokogawa's extensive capabilities in the following areas.

### ● Column technology

The column is the heart of a gas chromatograph. Yokogawa's application technology is backed by field experience with thousands of column types.

### ● Microprocessor application technology

Yokogawa has been using microprocessors in its gas chromatograph for nearly 20 years.

### ● Accumulated application knowhow

Column and sampling system designs are backed by field experience with 5,000 units in every kind of industry.

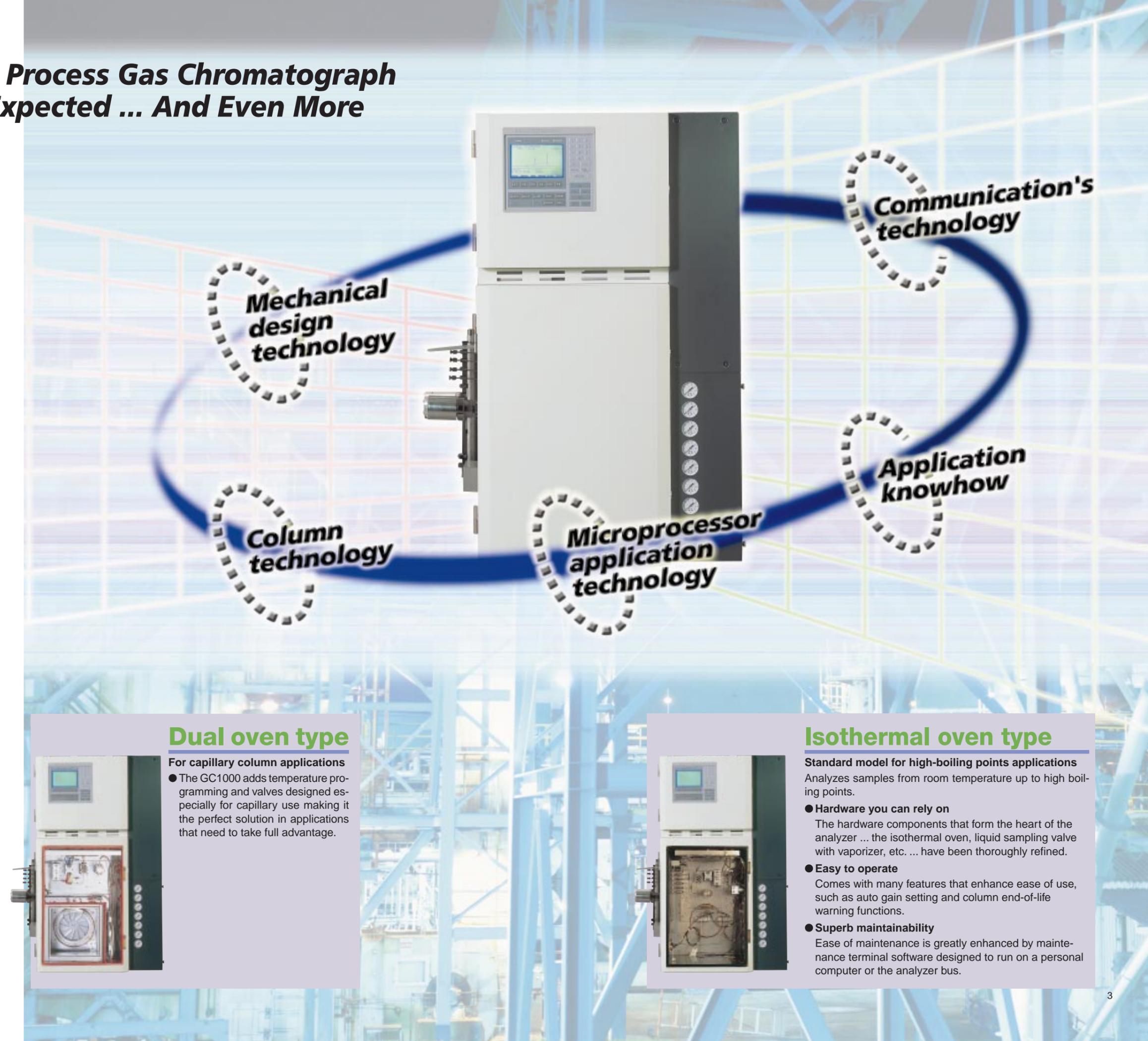
### ● Communications technology

Communications technology finely honed in the DCS arena supports gas chromatograph networks of the most advanced design, anticipating the needs of the coming era of open architecture.

### ● Mechanical design technology

The Yokogawa gas chromatographs have a well established reputation for the long life and outstanding maintainability of their valves and high-sensitivity detectors.

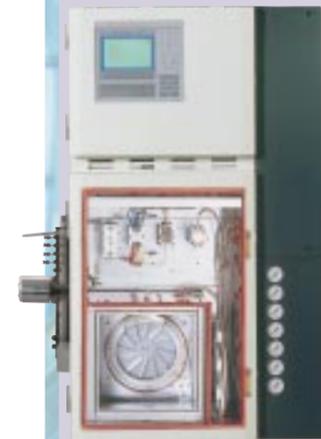
Based on this solid technology foundation, the new Yokogawa GC1000 series process gas chromatographs offer everything you need to configure systems that fit your needs.



## Dual oven type

### For capillary column applications

● The GC1000 adds temperature programming and valves designed especially for capillary use making it the perfect solution in applications that need to take full advantage.



## Isothermal oven type

### Standard model for high-boiling points applications

Analyzes samples from room temperature up to high boiling points.

### ● Hardware you can rely on

The hardware components that form the heart of the analyzer ... the isothermal oven, liquid sampling valve with vaporizer, etc. ... have been thoroughly refined.

### ● Easy to operate

Comes with many features that enhance ease of use, such as auto gain setting and column end-of-life warning functions.

### ● Superb maintainability

Ease of maintenance is greatly enhanced by maintenance terminal software designed to run on a personal computer or the analyzer bus.





# Dramatically Improved Ease of Use

## Operating Display

All operations are easily accessed using the operating display panel keys. Analyzer information is displayed in simple English on the LCD display. You can easily call up all the information you need ... operating status, alarm displays, analysis results, temperature status, chromatograms, and operating parameters ... just by pressing single keys.

## Liquid Sampling Valve With Vaporizer

This high-performance liquid sampling valve vaporizes the liquid sample in a temperature-controlled section and then injects it directly into the column (packed or capillary) inside the isothermal or programmed-temperature oven, enabling analysis of high boiling point liquid samples.



## Electronic Circuits

The electronic circuits are mounted inside a pressurized enclosure. This microprocessor-based unit provides signal amplification, waveform processing, sequencing, PID temperature control, and external communications processing.

## Wiring Terminals

Terminal blocks are provided for connection of wiring between the gas chromatograph and the outside world.

## Isothermal Oven

This Isothermal oven features excellent temperature stability and pressurized construction. A PID temperature controller holds the oven internal temperature stable within  $\pm 0.03^{\circ}\text{C}$ , of a constant preset value. The oven houses the detectors, column, carrier regulators, and stream switching valves.



## Programmed-Temperature Oven

This oven provides program-controlled temperature across a wide temperature range. An air bath system with agitator fan ensures high temperature uniformity within the oven.

## Flow Control Unit

Contains the carrier gas pressure regulator valve, pressure gauge, and purge air pressure regulator. EPC (Electronic Pressure Control) is also available.



## Purge Controller Shutdown (Option)

An automatic interlock system is available to remove power to the GC1000 upon loss of pressure in the pressurized enclosures. When this happens, electrical isolation is provided for the power supply, all I/O, and the analyzer bus. When the area is known to be non-hazardous, an override function is available to facilitate maintenance and adjustment with the enclosures open.





# Newly Developed Hardware at the Heart of the Analyzer Significantly Enhances Analysis Reliability

## New Isothermal and Programmed-Temperature Ovens Achieve Outstanding Temperature Stability and Repeatability

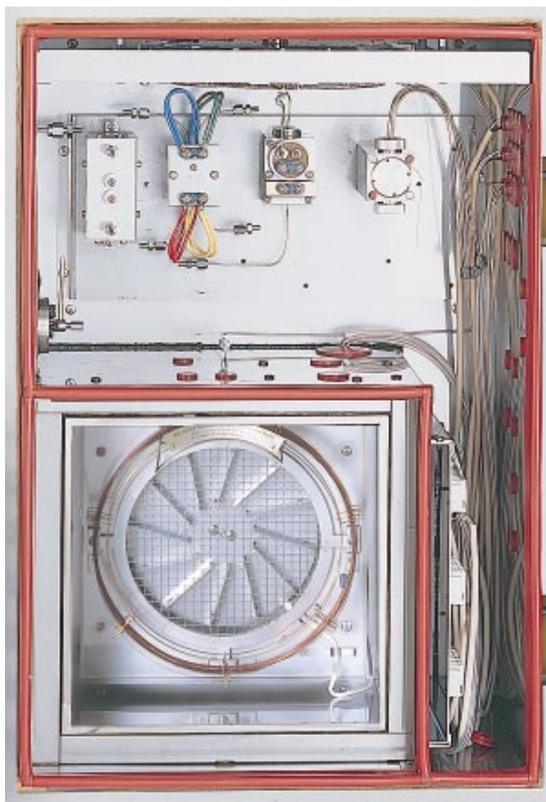
Highly stable temperature control in the isothermal or programmed-temperature oven is critical for stable gas chromatograph measurement performance. Temperature control accuracy, temperature program repeatability, and heating rate in particular are fundamental to performance, and the GC1000 instruments achieve outstanding characteristics in these areas thanks to the following features:

- 1) An air bath system enables fast control with even heating
- 2) An internal agitator fan driven by the sample purge air minimizes consumption and still ensures temperature uniformity inside the oven.
- 3) A recirculating heating system like those used in laboratory gas chromatographs reduces heater thermal capacity to nearly zero, permitting fast temperature response and highly stable control.

### Temperature Performance Specifications

Heating rate	1 to 30°C/min (settable in 1°C increments)
Ambient temperature influence	±0.1°C/10°C
Power supply voltage influence	0.03°C/10%

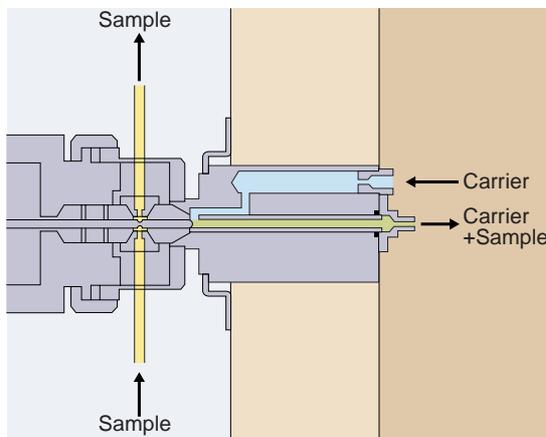
Isothermal oven volume is 40L, and programmed-temperature oven volume is 8.6L. Exploiting the advantages of the air bath system has enabled us to keep generous amounts of space free for ease of maintenance.



## Liquid Sampling Valve With Vaporizer Achieves Excellent Sealing Performance

The liquid sampling valve directly measures the amount of liquid sample, and contains a built-in vaporization heater independent of the oven heating system. After sampling, the liquid is vaporized and injected into the column at this heater's preset temperature.

The newly developed valve used in the GC1000 instruments features enhanced sealing performance and a simplified design in the seal area for easier maintenance. The result is significantly increased reliability of analysis across a much wider range of boiling points.



## Capillary Columns



Capillary columns offer separation capability an order of magnitude faster than packed columns. Thus they are highly attractive for analysis of high boiling point or adsorptive samples. Since The GC1000 features hardware that enable laboratory GC analysis conditions to be employed without compromise in process applications, you can take full advantage of the high separation capability of these capillary columns.

## Highly Reliable, Field-Proven Stream Switching Valves



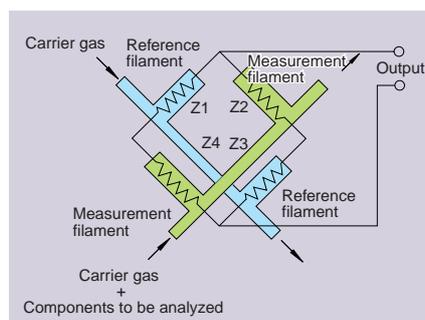
These stream switching valves are the fruit of Yokogawa's more than 30 years of process gas chromatograph experience and feature excellent maintainability.

Compared to those used in laboratory chromatographs, they are much better suited to the extreme conditions of process applications, and are one of the defining differences between laboratory and process GC hardware.

The GC1000 is equipped with improved valves that are even better able to withstand continuous high-temperature operation.

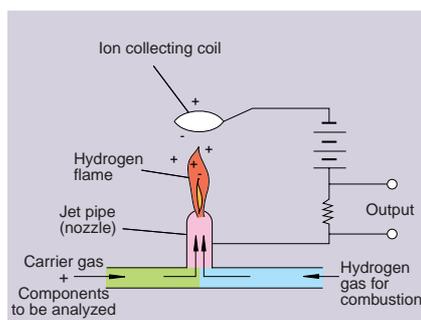
## Fast, Highly Sensitive Detectors for Those Sharp Capillary Column Peaks

### TCD



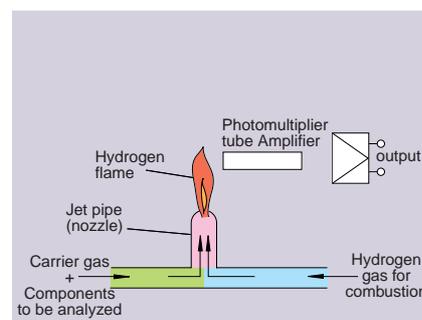
A fast-response detector with a mere  $11\mu\text{ l}$  of cell volume. Handles a wide range of applications, from inorganic gases to hydrocarbon gases.

### FID



Superior S/N ratio permits high-sensitivity measurement down to the 0 to 1 ppm range. Used for analysis of hydrocarbon gases in minute quantities.

### FPD



Used for analysis of sulfur compounds in minute quantities, due to selectively higher sensitivity to sulfur components.

# Easy Operation Via User Friendly Displays

## Main Features

- **Direct display of analytical data:** Display operating status information, chromatograms, and other data with one touch via dedicated keys.
- **Column end-of-life warning function:** A column end-of-life warning can be obtained by setting numeric criteria for column retention time, separation, and tailing factor according to the application.
- **Auto gate tracking function:** Automatically varies gate time according to the retention time for a particular peak.
- **No need for gain settings:** Analyses can be performed even without gain setting prior to analysis start.
- **Selectable operating modes:** The following operating modes are available for selection according to the user's needs.
  - Process mode: Normal process measurement mode.
  - Lab mode: Similar functions to lab GC where peaks are automatically integrated without established gates.
  - Manual mode: Used during startup and adjustments.
- **Selectable user levels:** Allows restricted access to the LCD display according to password protected user levels ... from just displaying results, status, and chromatograms, to activating calibrations and changing integration parameters.

## Operating Display Unit

**Alarm indicator lamps**  
LED lights when alarms occur.

**Dot-matrix LCD**  
Displays information such as operating status, alarm history, analysis results and history, temperature status, chromatogram, operating pattern parameters, etc.

**Function Keys**  
Used to select functions in the various modes such as operating status display, alarm display, etc.

**Display selection keys**  
Used to select display of information such as operating status, analysis results, chromatogram, etc. The "LOCAL/REMOTE" key selects whether operations are to be performed locally or by remote control.

**"LOCAL" indicator**  
Lights when chromatograph is in local mode.

**"POWER" lamp**  
Lights when power is on.

**Data entry keys**  
Used to enter component names and stream names.

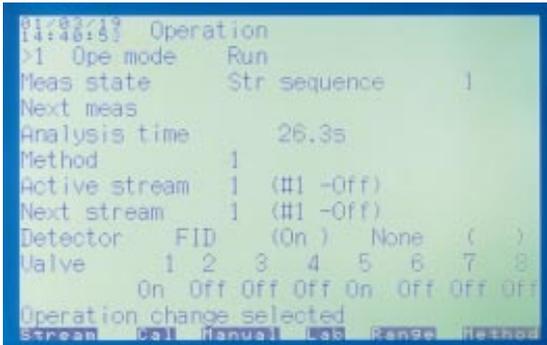
**Cursor movement keys**  
Used to shift the cursor on the display.

**Paging keys**  
Used to page forward and backward through displays.



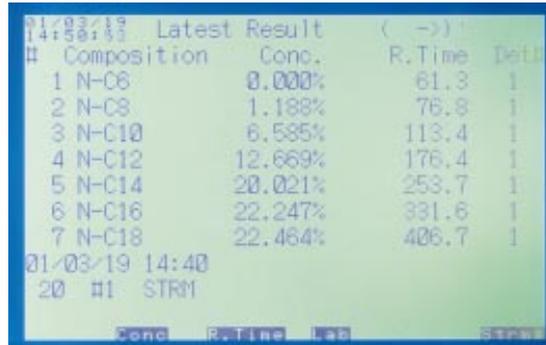
## LCD Display Examples

### Operating Status



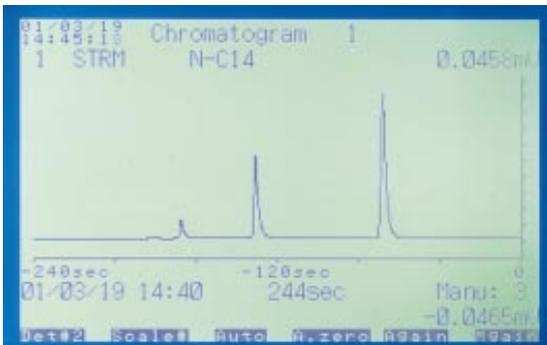
Displays operating pattern information such as detector type(s) and temperature program mode.

### Analysis Results

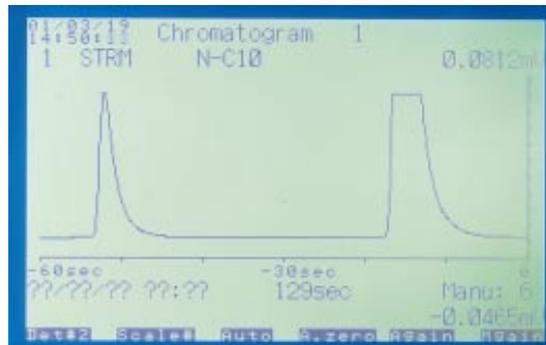


Displays data such as concentration and retention time for each peak in most recent analysis.

### Chromatogram



Display of analysis results in chromatogram form. (Example 1)



Display of analysis results in chromatogram form with expanded time axis. (Example 2)

### Active Alarms



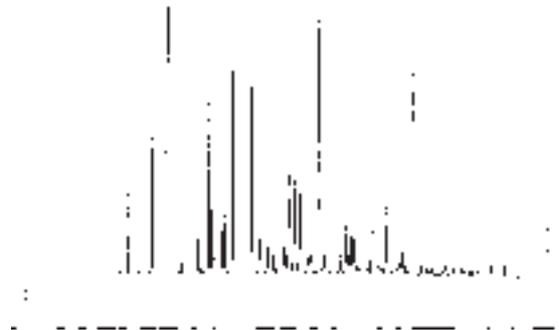
Displays alarms generated during analysis, with time of occurrence and description of type.



# Capability That Proves Worth in New Applications

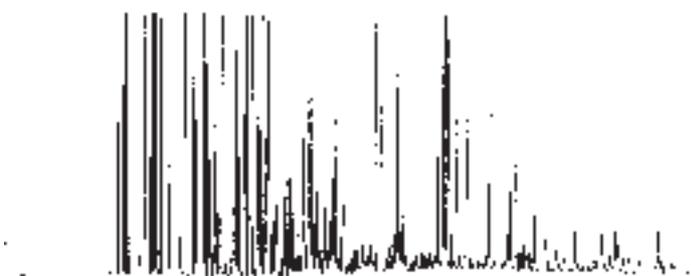
## Naphtha Analysis

Programmed-temperature operation dramatically shortens analysis time for wide boiling range liquids such as naphtha with no sacrifice in resolution.



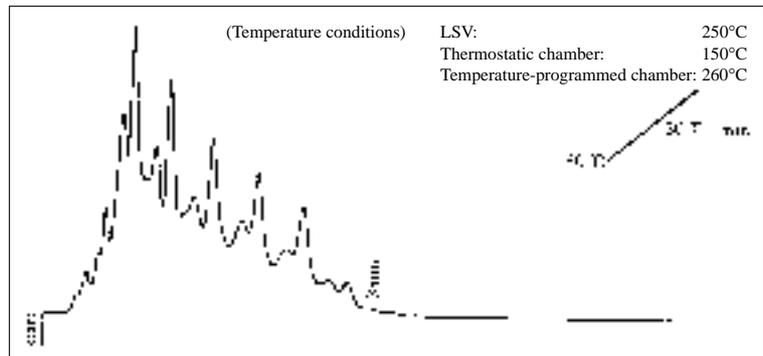
## Gasoline Analysis

With features such as programmed-temperature oven, liquid sampling valve with vaporizer, and capillary columns, gasoline analysis is now possible.

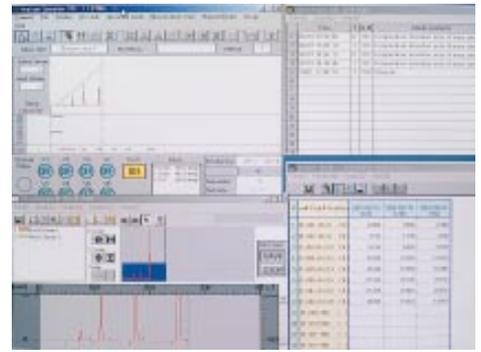


## Simulated Distillation Analysis

Distillation analysis is a tool used to ensure the quality of hydrocarbon mixtures. With its highly repeatable programmed-temperature oven and well-designed liquid sample valve, the GC1000 has proven very reliable in providing results in accordance with acceptable ASTM methods.

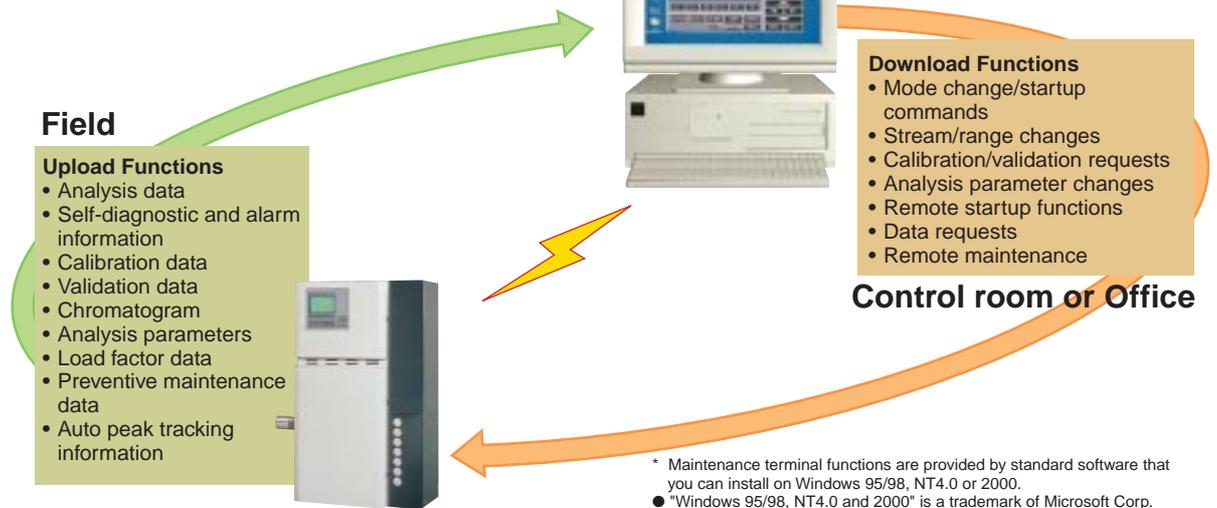


# Analyzer Bus and Personal Computer Software Enable Networking and PC-Based Maintenance



## Maintenance Terminal Software

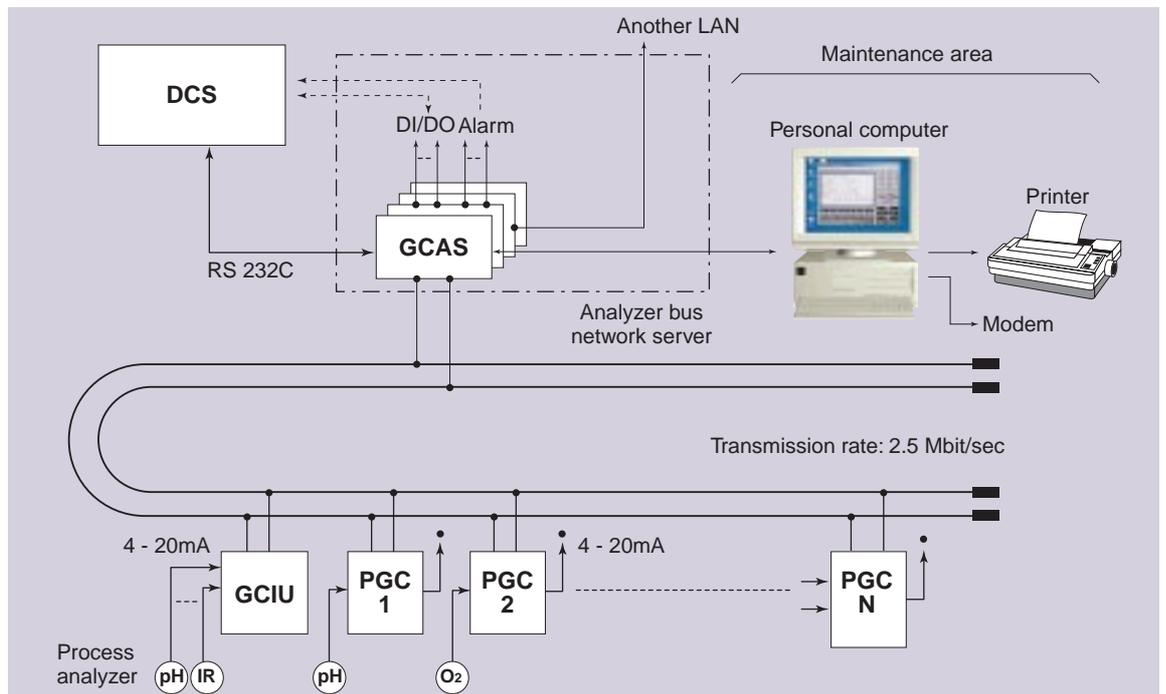
With our maintenance terminal software, you can operate your GC1000 process gas chromatographs from a PC in the control room, your office or any centralized location. This significantly simplifies maintenance.



## Our State-of-the-Art Analyzer Bus Lets You Build A Total Maintenance Management System

Link all of your process analyzers via our Analyzer Bus to achieve centralized maintenance management and data acquisition capabilities.

- High-speed bus: Approximately 2.5 Mbit/s (using coaxial cable or fiber optic cable).
- Maximum distance: 107 km (using repeaters).
- Maximum number of connected units: 254 (analyzers + interface units)
- Fully redundant configuration



# General Specifications

## General Specifications

Measurable object: Gas or liquid  
Measurement principle:  
    Component separation ... Elution method  
    Detection ... TCD, FID, FPD  
Measurable range:  
    TCD ... 1 ppm to 100%  
    FID ... 1 ppm to 100%  
    FPD ... 1 ppm to 0.1%  
Number of streams to be measured:  
    Maximum of 31 (including standard sample)  
Number of components to be measured: Maximum of 255  
Analysis period: Maximum of 99999.9 sec  
Materials in contact with sample:  
    Stainless steel (SS316), PTFE fluoro rubber, glass  
Repeatability: 1% of full scale (2 $\sigma$ )  
    Note that the value varies depending upon specifications and conditions. For details, contact YOKOGAWA.

## Analyzer

Explosion protection: Pressurized protected construction  
    JIS Expds IIB + H2, T1 to T4  
    FM/CSA X-purging, Y-purging  
        Class 1, Div 1, Grps B, C, and D T1 to T4  
    CENELEC IEC EEX pd IIB + H2, T1 to T4 (Applying)  
Structure: Drip-proof and dust-proof construction (NEMA3R IP53)  
Operating ambient temperature: -10 to 50°C, 95% RH or less.  
Weight: Approximately 120 kg

## Isothermal Oven Type

Content volume: 40 L  
Temperature setting: Setting with fixed set-point  
Setting temperature range:  
    55 to 225°C (Temperature can be set on 1°C basis.)  
Temperature control: PID control  
Temperature control accuracy:  $\pm 0.03^\circ\text{C}$

## Programmed-Temperature Oven Type

Content volume: 8.6 L  
Setting temperature range  
    Without cooler: 60 to 320°C  
    With cooler: 5 to 320°C  
Temperature-rising program: Maximum 3 steps  
Temperature-rising rate:  
    1 to 30°C/min (Temperature can be set on 1°C basis.)  
Temperature control: PID control  
Temperature control accuracy:  $\pm 0.03^\circ\text{C}$

## Input/Output

Analog input/output: 4 points/36 points 4 to 20 mA (isolated)  
Contact input/output: 8 points/8 points (dry contact)  
Personal computer communications: 33.6/19.2 K bps RS422  
DCS communications:  
    1200/2400/4800/9600/19200 bps (selectable) RS422 (For flammable areas, a special RS422/RS232-C convertor is available.)

## Utility

Power supply: 100 to 120 V AC  $\pm 10\%$ , 50/60Hz  $\pm 5\%$  or  
    200 to 240 V AC,  $\pm 10\%$  (max. 250 V AC) 50/60Hz  $\pm 5\%$   
Power consumption: Maximum of 3.3 KVA (Dual oven type)  
Maximum of 1.6 KVA (Single oven type)  
Instrument air:  
    Pressure: 350 to 900 kPa  
    Flowrate: 150 L/min or more (Dual oven type)  
    100 L/min or more (Single oven type)  
Carrier gas:  
    Kind of gases Any one or two of H<sub>2</sub>, N<sub>2</sub>, He, and Ar  
    Purity 99.99% minimum or more (Dew point -60°C or less)  
    Consumption 60 to 300 mL/min  
H<sub>2</sub> fuel for FID/FPD, burner air for FID/FPD  
    Purity 99.99% minimum or more (Dew point -60°C or less)  
    Pressure: 400 to 700 kPa  
    Consumption:  
        H<sub>2</sub> fuel Approximately 40 mL/min per detector  
        Burner Air Approximately 300 mL/min per detector

## External dimensions

FM/CSA Y-purging Type

Unit:mm

