

# General Specifications

## GC1000 Communication Function and GCMT Gas Chromatograph Maintenance Terminal

GS 11B3G1-01E

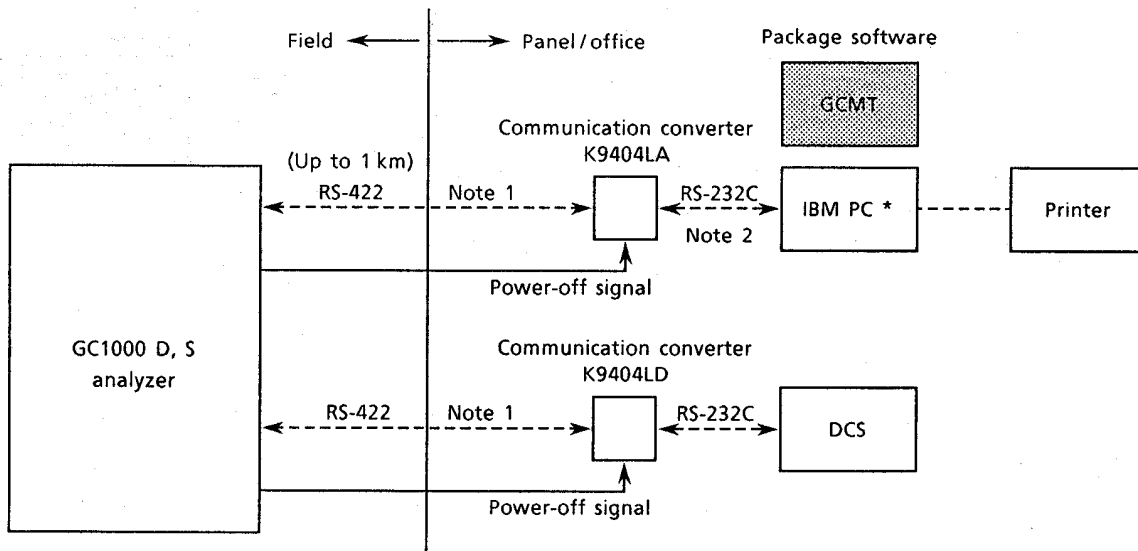
### GENERAL

Two types of communications are provided for GC1000 process gas chromatograph: DCS and personal computer (PC) communications.

DCS communication transmits analytical and other data to a DCS system, such as CENTUM, in digital form.

PC communication is that provided for the purpose of GC1000 maintenance. By incorporating GCMT package software in a general purpose use IBM\* PC, the PC can keep chromatograms, check them by superimposition, and save other data. This makes it possible to handle higher quality data and makes operation easier than conventional methods that mainly use recorders.

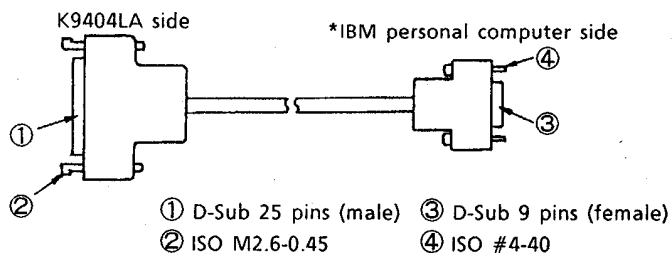
### 1. SYSTEM CONFIGURATION



Note 1: Cable recommended for RS-422 serial communication

15.0 mm OD (polyethylene-shielded) for 1.25 mm<sup>2</sup>, 3 twisted pairs (for one-way communication)  
 16.0 mm OD (polyethylene shielded) for 1.25 mm<sup>2</sup>, 5 twisted pairs (for two-way communication)

Note 2: Cable recommended for PC communication (wiring: Please refer to page 8.)



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## 2. DCS COMMUNICATION

### 2.1 Communication Specifications

**Communication Standard :**

- RS-422 (between the GC1000 and the K9404LD communication converter)
- RS-232C (between the K9404LD communication converter and the DCS)

**Start-stop System :** Start bit 1

Stop bit 1

Parity 1

**Data Signal Rate :** A maximum of 1200 or 2400 bps (switched from the keyboard of the analyzer)

**Error Detection :** Parity check (even parity)

**Line Form :** 4-wire type + 2 (power-off signal)

However, the power-off signal is used only between the GC1000 analyzer and the communication converter.

**Communication Data Format :**

ASCII 7-bit code

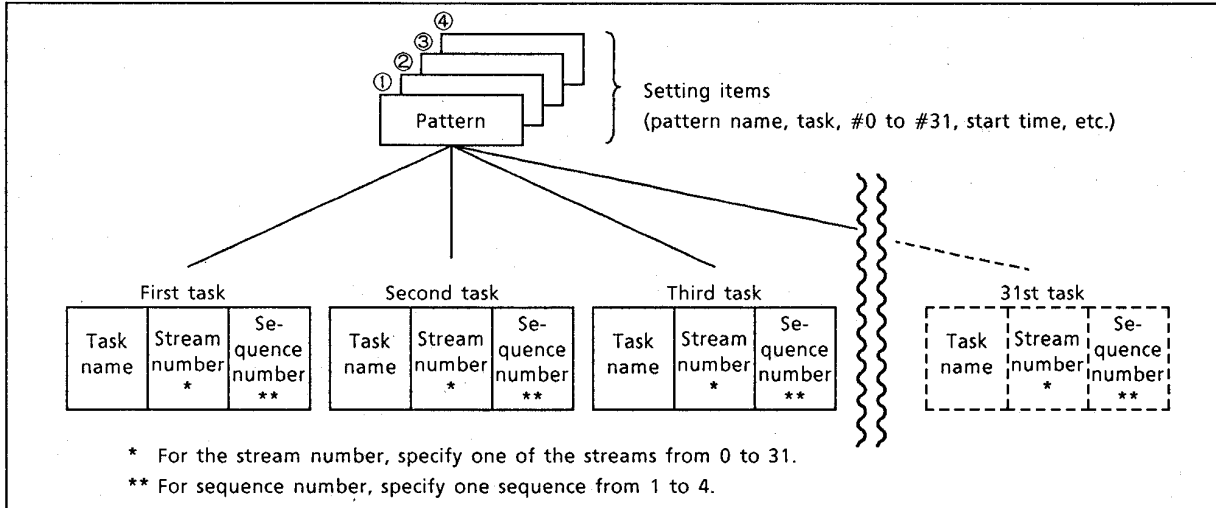
(Select either 'no control' or 'exclusive handshake'.)

No control = Output at any time when transmission data are generated

Exclusive handshake (Refer to communication control protocol or P.6)

**Transmission :** Full duplex

### 2.2 Concept of Switching Streams in the GC1000



Conceptual Diagram

Streams are switched as shown below in the GC1000.

- ① Newly provided or changing patterns
- ② Newly provided or changing tasks
- ③ Operation in manual mode

(1) **Pattern Types**

Four operating patterns can be set using the following three types in the GC1000.

- ① **Main pattern**  
: Normal process operation pattern
- ② **Time-start pattern**  
: A pattern which starts the GC1000 by interruption at a preset time (used for periodical calibration command or the like)
- ③ **Setting-interrupt pattern**  
: A pattern operated once after the presently proceeding main pattern task after setting (used for irregular calibration command and the like)

(2) **Pattern Setting Items**

The following items can be set in one pattern :

- Pattern name
- Operation start time/time interval
- Task number (up to 31 tasks may be registered)
- Other

(3) **Task Setting Items**

The following items can be set in one task.

- Task name
- Stream number (0 to 31)
- Sequence number (1 to 4)
- Other

(4) **Sequence Setting Items**

Four types of sequences can be set.

- Setting items
- Valve on/off time
  - Temperature (programmed temperature) pattern
  - Analysis period
  - Other

## 2.3 Input Signal

### (1) Types of Signals

#### ① Main pattern switching

Switching command

Stream data

#### ② Interruption command

CAL1 1 interruption command

CAL2 2 interruption command

CAL3 3 interruption command

#### ③ Stop/run command

(Note) When a stop command is received during analysis, the operation is stopped at the time the current task being analyzed is completed (stopped when the first-possible time is reached).

### (2) Signal Level

- ON at the level of the receiving threshold value +3 V and above (for RS-232C)
- OFF at the level of the receiving threshold value +0 V or less (for RS-232C)
- Input impedance 3 to 7 k $\Omega$  (for RS-232C)
- Maximum permissible input voltage  $\pm 30$  V (for RS-232C)

### (3) Priority of Signal Transmission

In the order of occurrence

## 2.4 Output Signal

### (1) Types of Signals

#### ① Analytical value data

- Analyzer number (for communication with a supervisory computer)
- Stream number
- Component number
- Component concentrations (including component concentration failure alarm)
- Unit (ppm or %)
- Retention time (including retention time failure alarm)
- Computed value (component ratio computation or linear polynomial computation)

#### ② Failure alarm

- Types of alarms
- Baseline failure value
- Date and time of occurrence

#### ③ Other information

- Calibration coefficient (including sensitivity failure alarm)

### (2) Signal Level

- Output voltage : +9 V  $\pm$  3 V at ON (for RS-232C)  
-9 V  $\pm$  3 V at OFF (for RS-232C)
- Output impedance: 300  $\Omega$  (for RS-232C)

### (3) Specifying Presence / Absence of Output Signal Transmission

Analytical data and alarms are independently specified with analyzer keys.

### (4) Priority of Signal Transmissions

- Each signal is transmitted simultaneously upon occurrence.
- A failure alarm occurring during an analytical data transmission is prioritized at the delimitation of the data train (after the carriage return and line feed) in the case of no control.
- A failure alarm which occurs during the transmission of analytical data and calibration coefficient are transmitted after the transmission is completed (for exclusive handshake).
- If two or more failure alarms occur simultaneously, they are transmitted in the order of detection.

### (5) Instruction in Exclusive Handshake

#### • Output instruction

① Data (component concentration, computed value, calibration coefficient, failure alarm) receiving request

② Data transmission completion

③ Invitation of input command

(Note) This is made at the time of receiving data (component concentration, and computed value).

④ Answerback (command execution)

⑤ Answerback (command not executed)

#### • Input instruction

① Data transmission request

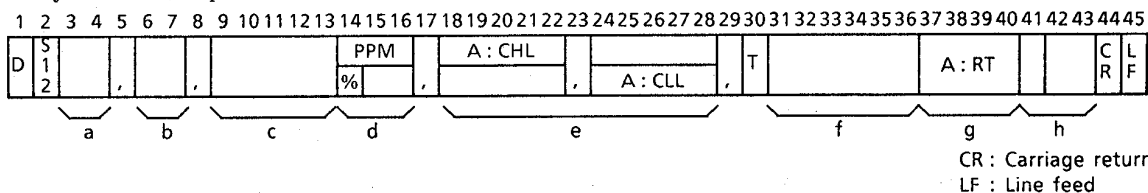
② Data retransmission request

(Note) For signal types and the communication control procedure, see the next page.

## 2.5 Data Format for DCS Communication

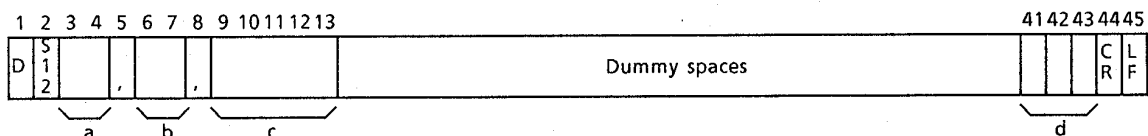
### (1) Output Data Format (45 characters, fixed)

#### ① Analytical data (component concentration)



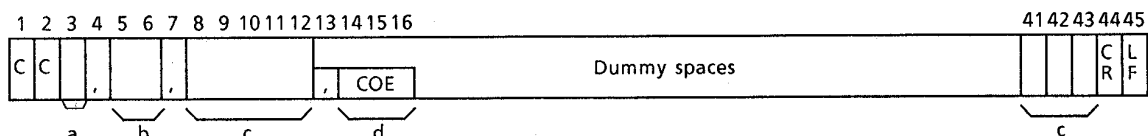
- a : Task number (1 to 31)
  - b : Component number (1 to 99) when the head is DS  
Component number 0 to 99 (100 to 199) when the head is D1  
Component number 0 to 55 (200 to 255) when the head is D2
  - c : Component concentration (without zero suppression)
  - d : Unit
  - e : Concentration failure alarm (upper limit=A: CHL; lower limit=A: CLL)
  - f : Retention time (sec)
  - g : Retention time failure alarm
  - h : Analyzer number 1 to 250 (zero suppression provided)
- (Note) A failure alarm is inserted only when it occurs (if an alarm does not occur, dummy spaces are inserted).

#### ② Analytical data (component ratio calculation and linear polynomial calculation)



- a : Task number
- b : Calculation number (1 to 99) when the head is DS  
Calculation number 0 to 99 (100 to 199) when the head is D1  
Calculation number 0 to 55 (200 to 255) when the head is D2
- c : Computed value (without zero suppression)
- d : Analyzer number 1 to 250 (zero suppression provided)

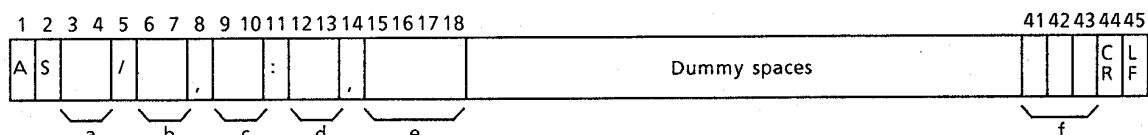
#### ③ Calibration coefficient



- a : Task number (1, 2, or 3)
- b : Peak number (1~99)
- c : Calibration coefficient (without zero suppression)
- d : Analyzer number 1 to 250 (zero suppression provided)
- d : Sensitivity failure (only when it occurs)

#### ④ Failure alarm

- Memory pattern check error
- Calibration error DET1 or DET2
- Pressure switch 1 (or 2) off
- FID1 (or 2) flame-off
- Watch-dog timer
- Programmed temperature oven over the temperature limit
- External contact input 1 to 8
- Poor calibration repeatability



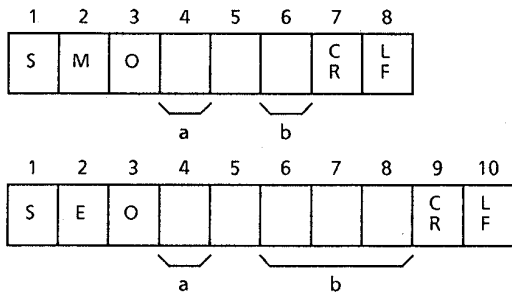
- a : Month
  - b : Day
  - c : Hour
  - d : Minute
  - e : Types of failure alarms
    - MEM : Memory pattern check error
    - WDT : Watch-dog timer
    - AD1 : Calibration error DET1
    - AD2 : Calibration error DET2
    - TMPH : Programmed temperature oven over the temperature limit
    - CAR1 : Pressure switch 1 off
    - CAR2 : Pressure switch 2 off
    - EXT1 : External contact input 1
    - EXT2 : External contact input 2
    - EXT8 : External contact input 8
    - FLM1 : FID1 flame-off
    - FLM2 : FID2 flame-off
    - RPT : Variation coefficient failure
- (Total 8 items)

#### <Data Format>

- a. Zero suppression not provided
  - Component concentration, • Task number, • Peak number, • Retention time, • Computed value, • Calibration coefficient, • Month/day/hour/minute
- b. Zero suppression provided
  - Analyzer number

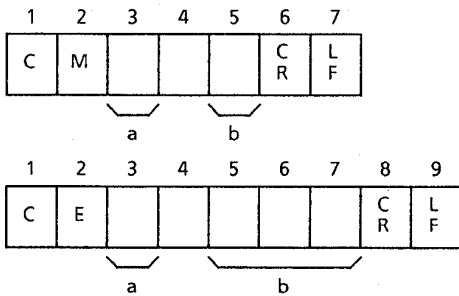
(2) Input Data Format

① Main-pattern-switching command



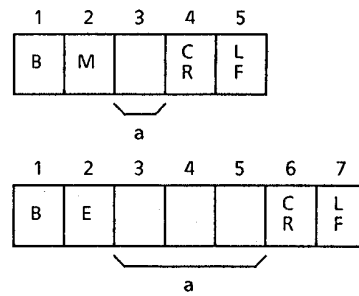
a: Pattern number b: Analyzer number

② Interruption pattern command (calibration or other command)



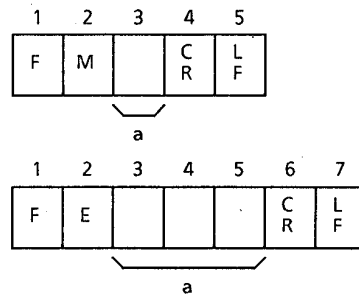
a: Pattern number b: Analyzer number

③ Run command



a: Analyzer number

④ Stop command



a: Analyzer number

<Data Format for Component Concentration>

The component concentration takes the following format by designating measurement ranges in the GC1000 peak setting table:

Measurement range	Output data format
0.001 to 9.999	X.XXX
10.000 to 99.999	XX.XX
100.000 to 999.999	XXX.X
1,000.000 and above	XXXXX

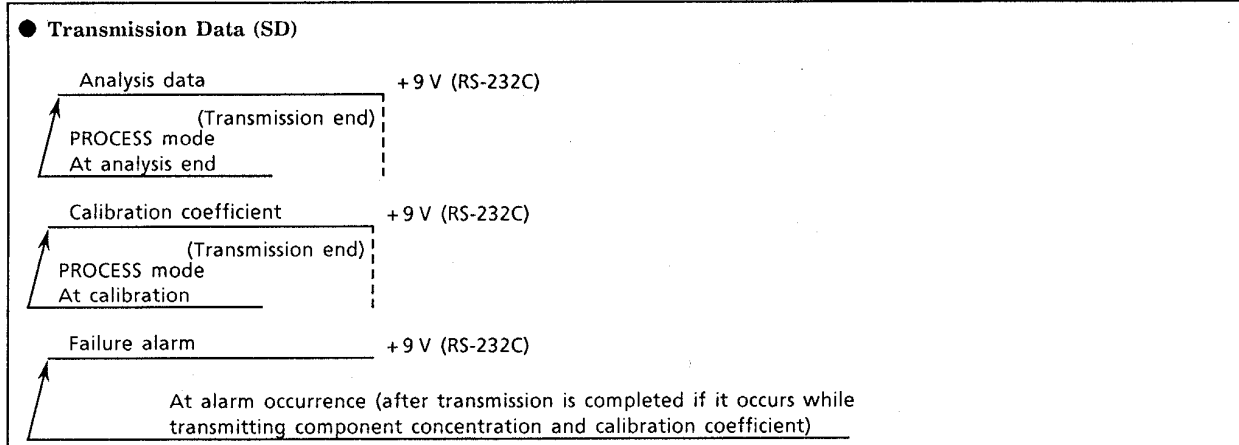
<Retention Time Data Format>

XXXX.X

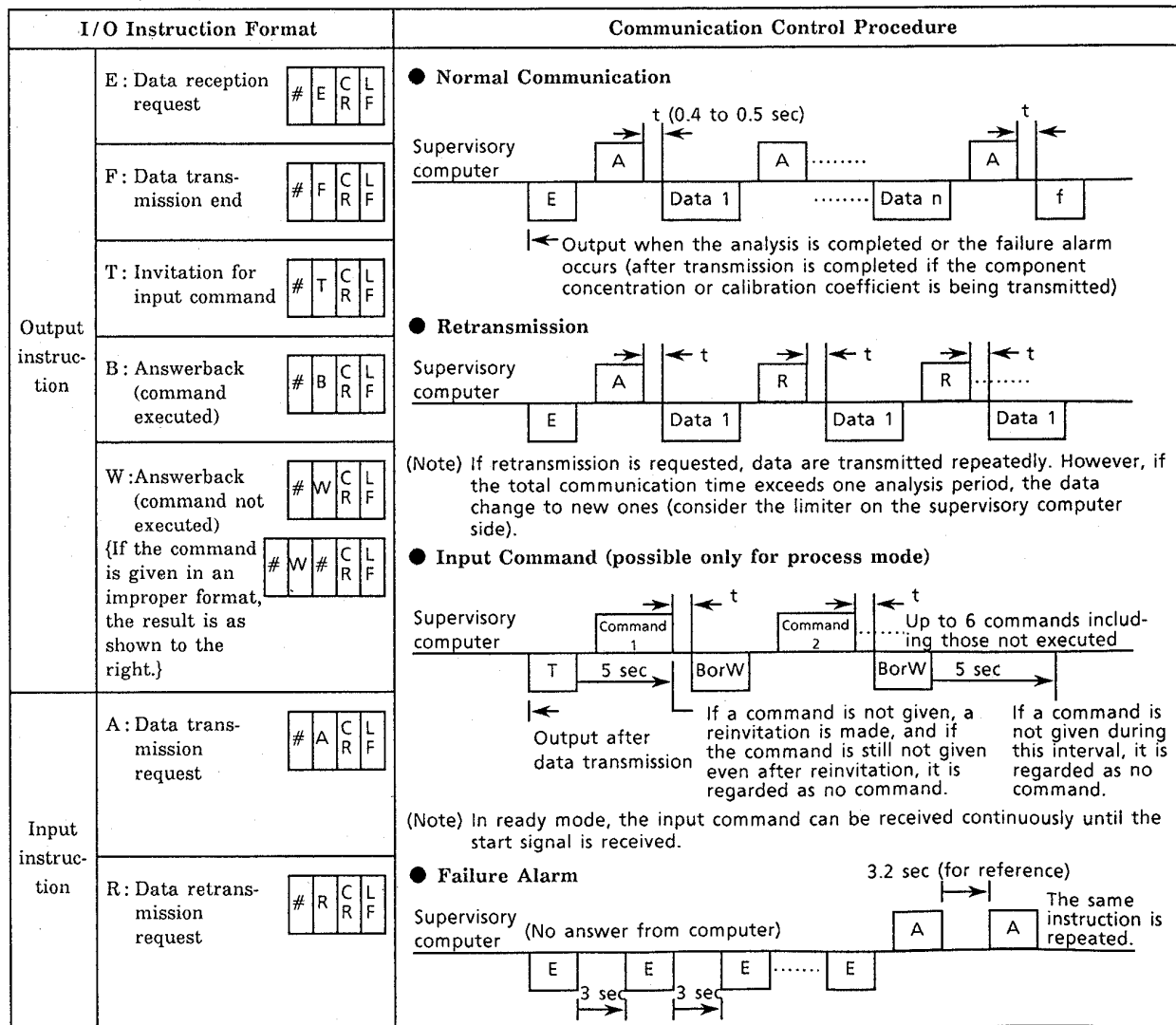
<Calibration Coefficient Data Format>

X.XXX

Output Transmission Timing in the Case of No Control



I/O Instruction Format and Communication Control Procedure in the Case of Hand Shake



(Note) If #ACRLF or #RCRLF is not received more than 20 seconds after data are transmitted, the analytical data transmission for that time is aborted.

**Reference: An Example of Error Control by Distributed Control System (DCS)**

1. **Parity Check**  
Even parity is used for GC1000 communication outputs. When an odd parity is received, the DCS regards the data as invalid.
2. **Check of Header**  
Each communication packet begins with two alphabet characters. The DCS regards any packet beginning with unidentified characters as invalid data.
3. **Check of Value**  
Analysis results and other data in a communication packet are numeric values. If data contain a non-numeric character where a number is supposed to be set, the DCS regards the corresponding data as invalid. (The decimal point position can also be checked albeit it has not yet been applied to real jobs.)
4. **Check of Number and Order of Components**  
The number and order of the analysis result data are fixed. If the order of received result data is wrong or if too many data are received, the DCS regards them as invalid data.
5. **Check of Character Length**  
The length of a communication output is fixed to 45 characters. The DCS regards any communication output having a length other than 45 characters as invalid data.

### 3. GAS CHROMATOGRAPH MAINTENANCE TERMINAL GCMT

The GCMT gas chromatograph maintenance terminal is package software for the IBM PC to maintain the GC1000.

#### 3.1 Operating Conditions

- (1) **Hardware**
  - Model : IBM\*PC and compatible models
  - Processor : 486-66MHz or better
  - Main memory : 8 MB or more (in case of windows 95, 16MB or more)
  - Hard disk : 80 MB or more (program space)
  - CRT resolution : VGA (680\*480) or higher
  - With a printer compatible with Windows
- (2) **Software Environment**
  - DOS (Ver. 5.0 or later)\*, Microsoft<sup>®</sup> Windows<sup>™</sup> Version 3.1\*\* or more new version must be installed.

#### 3.2 Communication Specifications

Communication Standard: RS232C (between PC and communication converter K9404LA)

Communication Rate : 9600 bps

Parameter : 8 data + stop bit, without parity, XON/XOFF control

#### 3.3 Functional Configuration

The GC maintenance terminal basically has the next two functions.

- ① The number of analyzers that can receive service simultaneously is one.
  - ② Only the data that the analyzer currently has are handled.
- (1) **Connection Link to Analyzer**  
Communication processing is independent of display processing and always updates the database. It also controls communications so that operating commands from display processing are transmitted to the analyzer on a real-time basis via communications.
  - (2) **Displaying Operation on the Display**  
Display processing indicates the data in the database on the display and updates the display with the messages for updating via communications. The operation mode can be changed and valves can be opened/closed on the display.
  - (3) **Data Storage and Display**  
The database and chromatograms can be stored in files and redisplayed using the file display function.
  - (4) **Data Computation Processing**  
The PC maintenance terminal computes and processes the analytical data and chromatogram data stored in the files. Also, sophisticated computations and processing of data for the analyzer can be easily carried out using general-purpose software, actively utilizing Windows characteristics.
  - (5) **Printing**  
The display of the PC maintenance terminal can be printed out (hard copy) with the printer. Any printer can be used as long as that model is provided with a Windows printer driver.
  - (6) **Installation**  
This is a function to install the PC maintenance terminal function in a PC. Installation work includes directory creation, execution-file loading, configuration.

#### 3.4 Display Panel and Operation

The display panels which the system indicates are roughly composed of the following five types: These can be simultaneously displayed except for the LCD panel emulator panel.

- (1) Operating status display panel
- (2) Analytical data display panel
- (3) Chromatogram display panel
- (4) Alarm display panel
- (5) LCD panel emulator panel

#### 3.5 GC Maintenance Terminal Model Codes

Model	Basic Code	Optional Code	Description
GCMT	.....	.....	Software package
Function	-A01.....	.....	Standard
Language	"E"	.....	English

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Items with \*\* are trademarks of Microsoft Corp.

#### 4. COMMUNICATION CONVERTER K9404LA, K9404LD, RS232C COMMUNICATION CABLE, Figure, Wiring

This communication converter converts communications from RS-422 to RS-232C for PC or DCS communication as well as shuts off the communication signals when a power-off signal is received from the analyzer. This maintains explosion protectiveness on the analyzer side.

##### 4.1 Signal Terminals on the GC1000 Side

- ① RS-422 SDA, SDB, RDA, RDB } M4 terminals
- ② D/I 12 V +, -

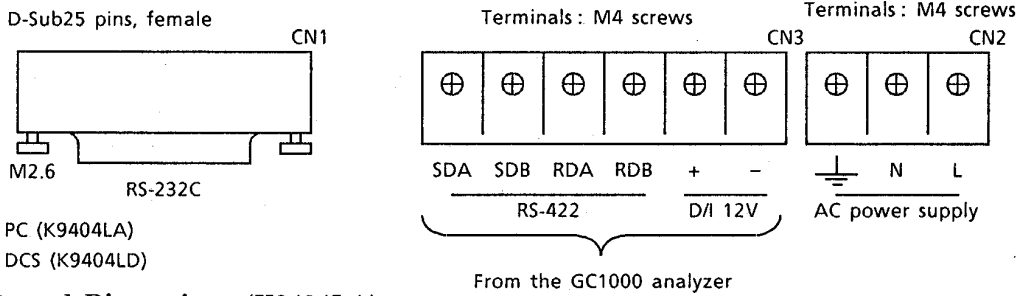
##### 4.2 Signal Terminals on the Communication Equipment

- ① RS232C D-Sub25 female terminals

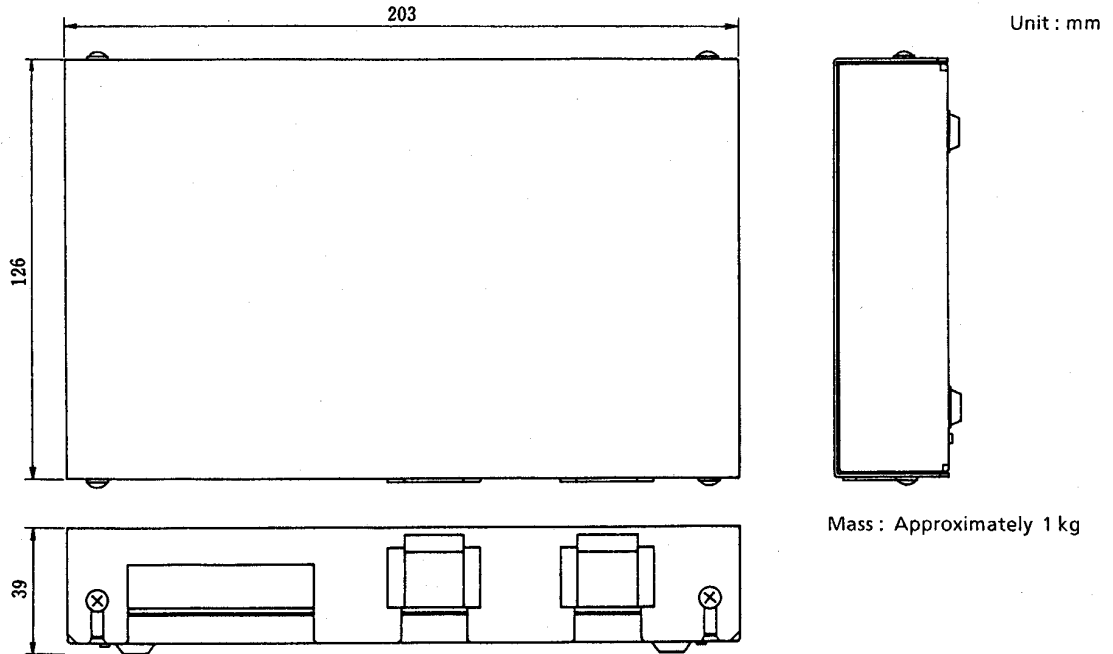
##### 4.3 Power Supply

- 100 to 120 V AC ±10%, 50/60 Hz ±5% or
- 200 to 250 V AC, 50/60 Hz ±5%, M4 terminals

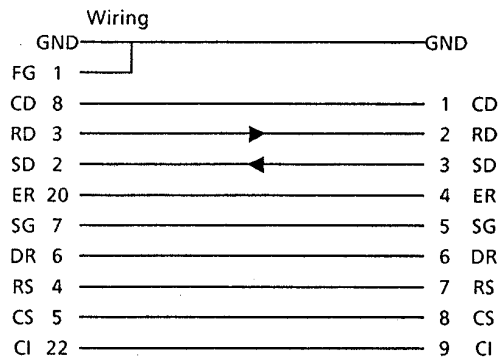
##### 4.4 Terminal Arrangement (common for K9404LA, LD)



##### 4.6 External Dimensions (K9404LA)



##### 4.5 PC Communication Cable (Straight type)

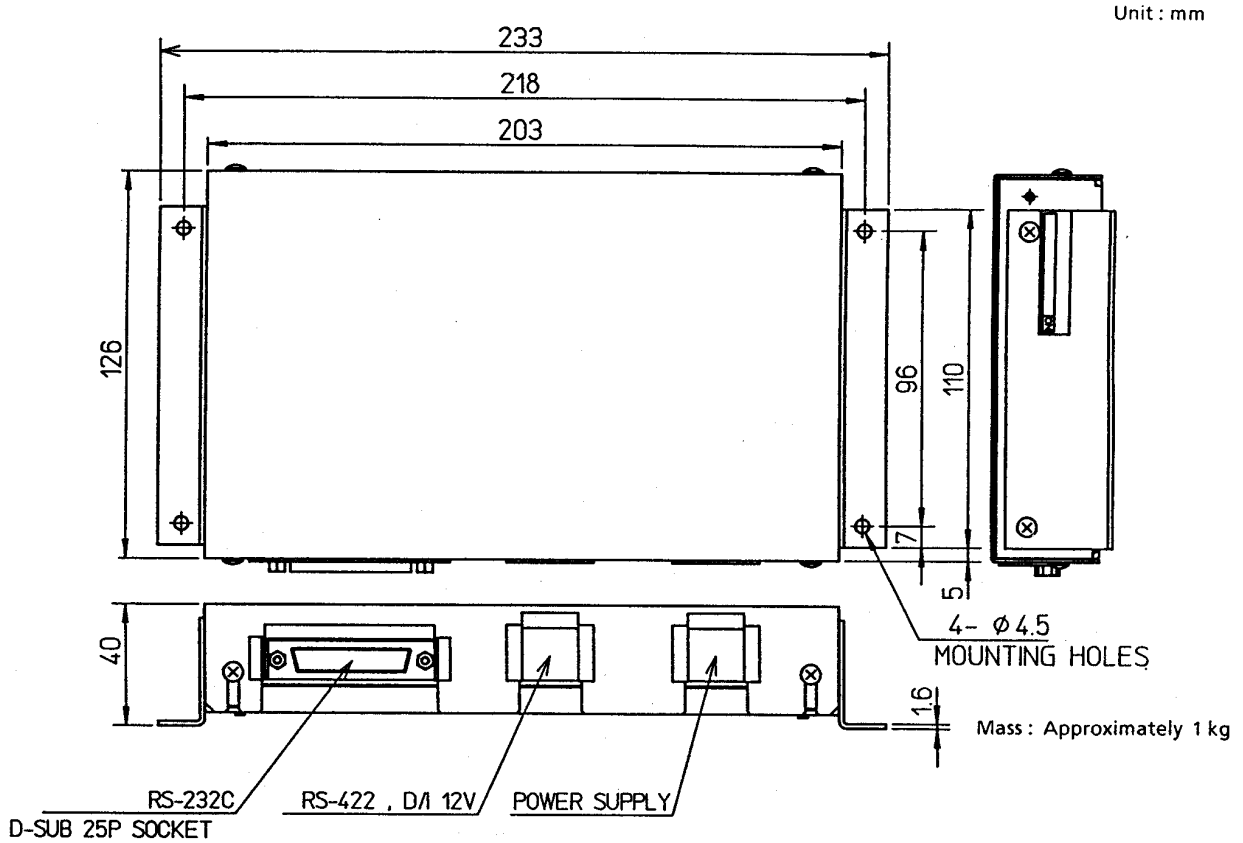


K9404LA side

\* IBM personal computer side

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### 4.7 External Dimensions (K9404LD)



### 4.8 Terminal RS232C: Wiring in the inside of converter (K9404LA, K9404LD)

