ESPEC

User's Manual

Bench-Top Type Temperature and Humidity Chamber

Option
Communication Function GP-IB/RS-232C

4009204001401

Models covered : SH-221, 241
SU-221, 241

⚠ • Read this manual carefully before using the equipment.
• Familiarize yourself with all safety precautions before using the equipment.
• Keep this manual handy for future reference.

ESPEC CORP.

Liability

ESPEC CORP. assumes NO responsibility whatsoever for accidents or equipment trouble arising from the failure to observe handling instructions contained herein. Do not perform any operation or handle the equipment in any way or form that is not described in this user's manual or which is herein specifically prohibited. Careless usage of the sort may result in unexpected damage to the equipment or accident.

Introduction

This manual has been written for users of Bench-Top Type Temperature and Humidity Chambers and particularly for technicians. Read it thoroughly to obtain the maximum performance from the chamber.

Safety Symbols

The following safety symbols are used throughout this manual.

Degree of DANGER

⚠ **VERY DANGEROUS**	**This mark means extremely dangerous consequences may arise, with the possibility of death or serious injury to the user, if the equipment is handled incorrectly.**
⚠ **DANGER**	**This mark means dangerous consequences may arise, with the possibility of death or serious injury to the user, if the equipment is handled incorrectly.**
⚠ **CAUTION**	**This mark means dangerous consequences may arise, with the possibility of somewhat serious injury to the user and/or damage to equipment and facilities, if the equipment is handled incorrectly.**

Keywords

The following keywords are used in this manual.

Note : Provides information necessary for gaining full performance from the chamber or to prevent damage to equipment.

Procedure : Explains how to operate the chamber on a step-by-step basis.

Reference : Offers supplementary information.

Document Composition

The user's manual composition that came with your chamber contains the following reference materials. Use them as necessary.

Manual	Content
Basic Operation (SH/SU)	Explains the basics of the SH/SU model Bench-Top Type Temperature and Humidity Chambers.
Reference	Explains chamber operations in greater detail.
Communication Function RS-485	Explains the RS-485 communication function.
Quick Reference	Reorganizes operation from the instrumentation panel into a simple, handy digest.
Options • **Communication Function GP-IB/RS232C** • **Temperature (Humidity) Recorder**	Explains how to use the communication function options. This manual shall always have priority of the above reference materials when found in disagreement.

Contents

Chapter 4   Example Applications

Chapter 5   Specifications

Chapter 1
Overview

1.1 Communication Function

The communication function connects a chamber to a computer or some other external device via a communication interface. This interface makes it possible to control the chamber as well as monitor chamber control status and the program being run with commands sent from the computer.

Reference | **Difference between "Computer Program" and "Test Program"**
A "computer program" is a program created on computer. It is different from the test program run in the chamber's program mode.

The communication interface is selected between GP-IB and RS-232C at the time of purchase.

GP-IB (IEEE488/HP-IB)

GP-IB (General Purpose Interface Bus) is a standard parallel interface used for attaching sensors and programmable instruments to a computer. It is officially known as IEEE488 (standard No. 488 of the Institute of Electrical and Electronic Engineers [USA]) and was based on the HP-IB (Hewlett-Packard Interface Bus) standard of Hewlett-Packard Company. Because data is sent over parallel circuits, transmission is fast.

RS-232C

RS-232C (Recommended Standard-232) is a serial interface widely adopted for transmission between computers and peripheral devices, and a communication standard of the EIA (Electronic Industries Association).
The interface connector will differ according to the connected computer. Check the specifications of your computer and prepare a cable that can make the signal connections given in "1.2 Communication Interface".

1.2 Communication Interface

GP-IB

The GP-IB conforms to IEEE488. Use a communication cable that also conforms to IEEE488.

RS-232C

The RS-232C interface is a serial modem (DCE). Use a cable with the interface connector specified for your computer.

1.3 Transmitted Data

This section explains data transmitted with the communication function. This data is the same for both GP-IB and RS-232C communications.

Types of Data

Data is handled as either command data or response data.

Command Data

Data sent from the computer to the chamber is treated as a command. Commands are of the following two basic types.

- Monitor Commands

  These commands are used to monitor the chamber's operating status and conditions inside the chamber.

- Setting commands

  These commands are used to change the chamber's operating mode or conditions inside the chamber such as target temperature/humidity.

Response Data

Data returned from the chamber in response to computer commands is treated as a response. Responses are of the following two basic types.

- Reception Status

  This response tells the computer whether the setting command it sent was processed correctly or not.

  When the setting command is correctly processed

  "OK : setting command"

  When the setting command is not correctly processed

  "NA : error message"

  (For details on error messages, see Table 1.1.)

- Monitor Data

  This data is sent in response to monitor commands from the computer.

  When the monitor command is correctly processed

  "monitored data"

  (For details on responses, see "3.2 Monitor Commands".)

  When the monitor command is not correctly processed

  "NA : error message"

  (For details on error messages, see Table 1.1.)

Data Format

Command Data Format

Command data sent from the computer has the following format.

command data		delimiter

Reference | Address

This communication function does not require the use of addresses, but it can recognize command data written with the below address header.

address ,	command data	delimiter

Response Data Format

The response data returned from the chamber to the computer has the following format.

response data	delimiter

Reference | About Main Commands and Optional Parameters

- Main commands and optional parameters are expressed as ASCII text in either capital or small case letters.
- Spaces between characters are automatically deleted.
- Temperature and control output data are valid to one place below the decimal. All other numerical data is recognized as a whole number.

Error Messages

When command data sent from the computer is not correctly processed by the chamber, the chamber returns an "NA :" code attached with an error message. These messages and their meaning are given here below.

Table 1.1 Error messages

Error message	Meaning	Example
COMMAND ERR	Chamber could not recognize the command data.	• When "TENMP?" is sent as the command. The correct command is "TEMP?".
ADDR ERR	Address error	• When an address is attached to a command which cannot be expressed with an address
CONTROLLER NOT READY-1	The chamber could not execute the command.	• When a humidity command is sent to a chamber which does not support humidity control
CONTROLLER NOT READY-2	The chamber could not execute the command.	• When a program related command is sent to a chamber when a program was not running
CONTROLLER NOT READY-3	The chamber could not execute the command.	• When the user attempts to lock setting keys when power is OFF
CONTROLLER NOT READY-4	The chamber could not execute the command.	• When the user attempts to change a time signal setting which cannot be changed
CONTROLLER NOT READY-5	The chamber could not execute the command.	• When a refrigerator command is sent to a chamber without a refrigerator
CONTROLLER NOT READY-6	The chamber could not execute the command.	• When a damper command is sent to a chamber without a damper
DATA NOT READY	The requested data cannot be found.	• When the user attempts to run a program which is not set up
PARAMETER ERR	Parameter error	• The parameter is missing in the command. • When the attached parameter can not be recognized.
DATA OUT OF RANGE	Data is out of the specified range.	• When the user sets a temperature (humidity) outside the setting range
PROTECT ON	Settings are protected against change by the protect feature.	• When the user attempts to change settings when the key lock is ON
PRGM WRITE ERR-1	Program editing error	• When the user attempts to write data without specifying the new program/overwrite mode
PRGM WRITE ERR-2	Program editing error	• When an edit command is sent while not in the edit mode
PRGM WRITE ERR-3	Program editing error	• When data is overwritten while the chamber is editing data
PRGM WRITE ERR-4	Program editing error	• When data is edited while the chamber is overwriting data
PRGM WRITE ERR-5	Program editing error	• When an overwrite command is sent while not in the overwrite mode

Cont. from previous page

Error message	Meaning	Example
PRGM WRITE ERR-6	Program editing error	• When a program different from that where now writing data is specified
PRGM WRITE ERR-7	Program editing error	• When a step No. is skipped or out-of-sequence
PRGM WRITE ERR-8	Program editing error	• When repeat counter setup is wrong
PRGM WRITE ERR-9	Program editing error	• When the user attempts to change a program while that program is running
PRGM WRITE ERR-10	Program editing error	• When the user attempts to set the repeat counter or end mode without first inputting the necessary settings
PRGM WRITE ERR-11	Program editing error	• When the user inputs invalid data
PRGM WRITE ERR-12	Program editing error	• When the user turns guaranteed soak control ON when ramp control is ON
PRGM WRITE ERR-13	Program editing error	• When the user turns humidity ramp control ON when humidity control is OFF

1.4 Data Transfer

GP-IB

Data transfer in GP-IB communications is as shown below. The computer sends commands (setting command or monitor command) to the chamber and the chamber returns a response (reception status or monitor data) to the computer.
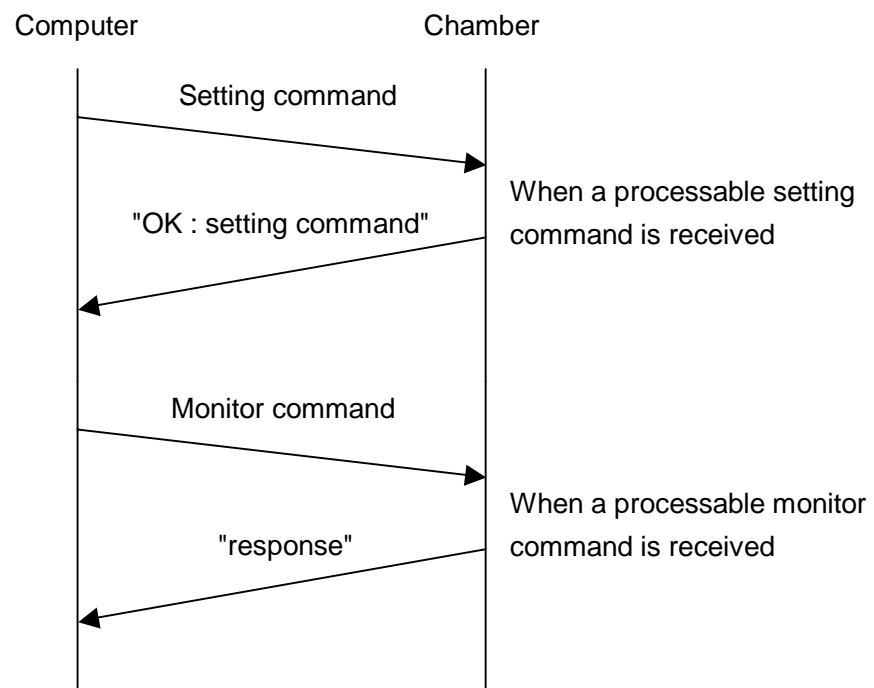
RS-232C

Standard Mode

The computer sends commands (setting command or monitor command) to the chamber and the chamber returns a response (reception status or monitor data) to the computer.
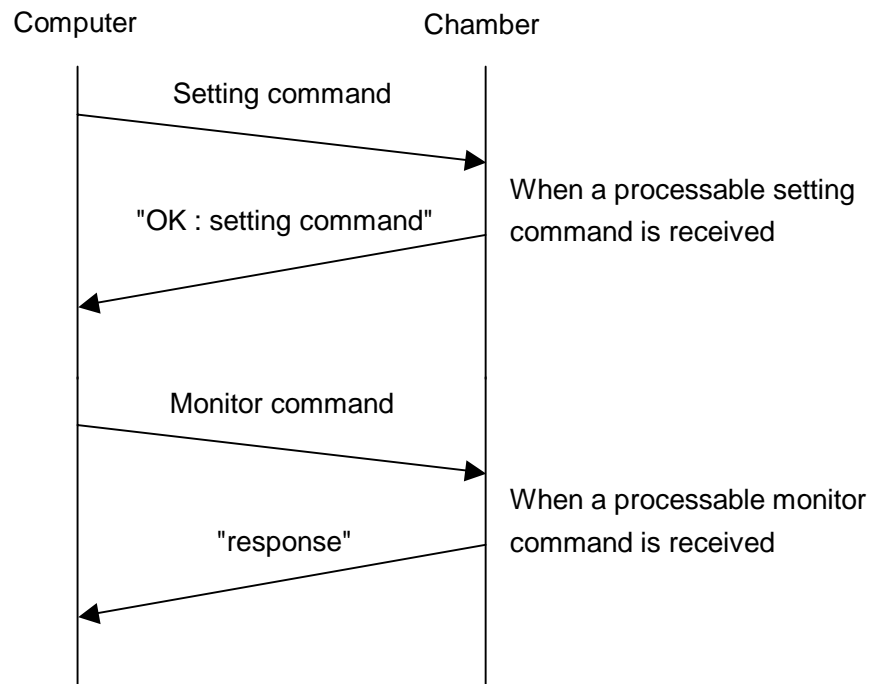
E-BUS Mode

When the E-BUS mode is selected as the data transfer mode, you have the choice of using echo back or not.

- When Echo Back is ON

  When echo back is ON, the chamber returns responses to the computer in the below format.

  Response to setting commands

  | reception status data | | delimiter |

  Response to monitor commands

  | reception status data | | delimiter | | monitored data | | delimiter |

  Therefore, when the entire response data including the delimiter is treated as a single data set, data transfer is as follows.

Computer   Chamber

Setting command

"OK : setting command"

When a processable setting command is received

Monitor command

"OK : monitor command"

When a processable monitor command is received
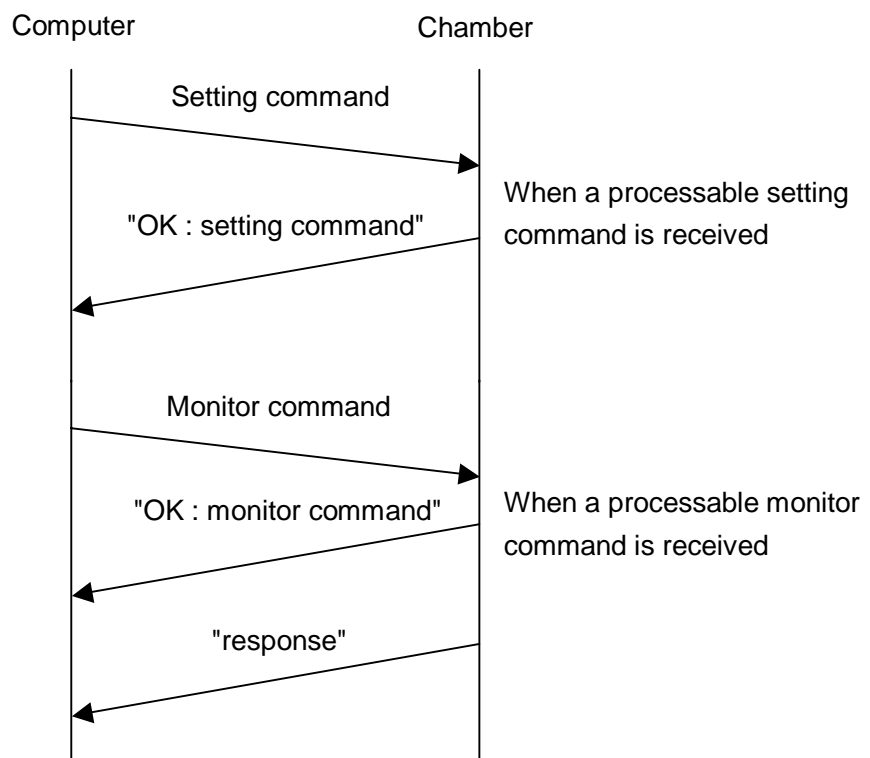
"response"

- When Echo Back is OFF

  When echo back is OFF, the chamber does not return a response to computer commands until it receives the data transfer trigger. With this communication function, "G" is used as the data transfer trigger instead of the command data. In this case, data transfer is as follows.

Computer   Chamber

Setting command

When a processable setting command is received, <u>the setting is changed on the chamber side, but a response is not returned.</u>

Monitor command

When a processable monitor command is received

"G"

<u>When the trigger is detected, response data is returned.</u>

"response"
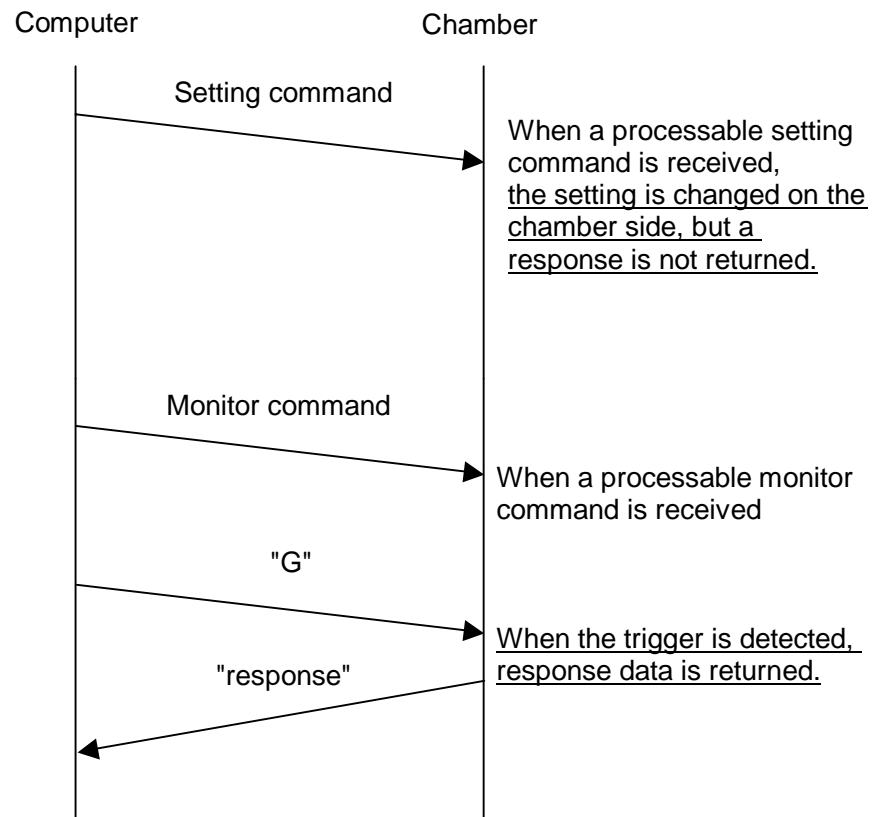
Chapter 2
Communication Setup

You can set up communications from the communication setup mode. For more information on this mode, see the User's Manual –Reference–.

GP-IB Communication Setup

Getting the communication setup mode and pressing the (NEXT) key one time

displays the first setting. The address setting is displayed for the option
communication function (GP-IB).

Address

```
 GP ib            -1
```
MONITOR   CONST. SET   PRGM SET   ALARM SET   SYSTEM

Stands for
"GP-IB"

Current address
Address can be set from 1 to 16.

Delimiter

```
 dEL i          C.L.E
```
MONITOR   CONST. SET   PRGM SET   ALARM SET   SYSTEM

Stands for
"DELIMITER"
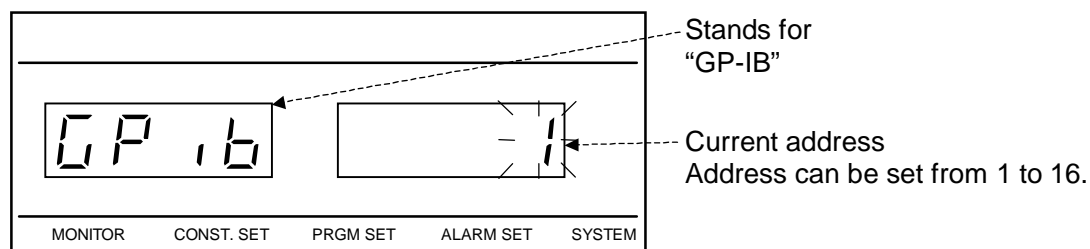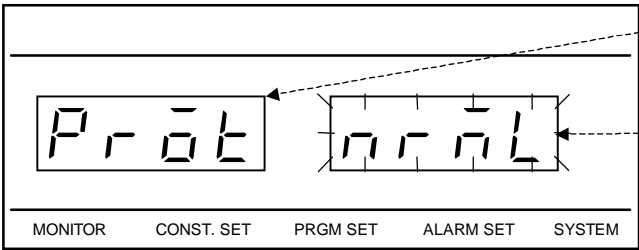
Current delimiter
  C.L.E : "CR+LF+EOI"
    L.E : "LF+EOI"
    C.E : "CR+EOI"
      E : "EOI"
    C.L : "CR+LF"
      L : "LF"
      C : "CR"
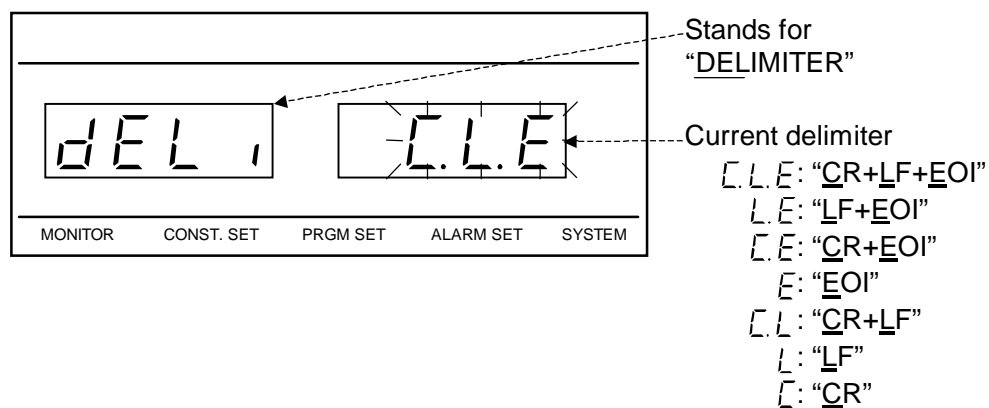
RS-232C Communication Setup

Getting the communication setup mode and pressing the (NEXT) key one time

displays the first setting. The transfer mode is displayed for the option

communication function (RS-232C).

Transfer Mode
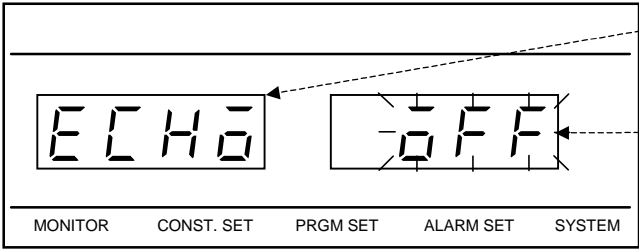
```
┌─────────────────────────────────┐
│  ───────────────────────────    │
│                                  │
│   Prot        nrnL               │
│                                  │
│  ───────────────────────────    │
│ MONITOR  CONST. SET  PRGM SET  ALARM SET  SYSTEM │
└─────────────────────────────────┘
```

Stands for
"PROTOCOL"

Current transfer mode
E.bUS   "E-BUS"
        E-BUS mode
nrnL   "NORMAL"
        Standard mode

Echo Back
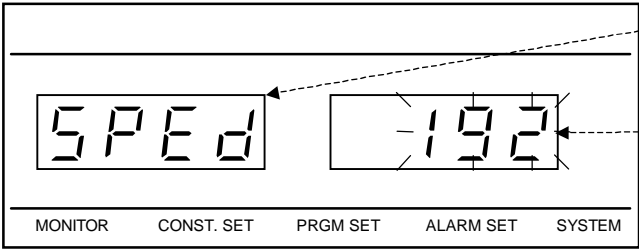
```
┌─────────────────────────────────┐
│  ───────────────────────────    │
│                                  │
│   ECHo         oFF               │
│                                  │
│  ───────────────────────────    │
│ MONITOR  CONST. SET  PRGM SET  ALARM SET  SYSTEM │
└─────────────────────────────────┘
```

Stands for
"ECHO BACK"

Current echo back control setting
        "ON"
          Echo back ON
        "OFF"
          Echo back OFF

The echo back setting is displayed only when the E-BUS mode is selected for
the transfer mode.

Transmission Speed

```
┌─────────────────────────────────┐
│  ───────────────────────────    │
│                                  │
│   SPEd         192               │
│                                  │
│  ───────────────────────────    │
│ MONITOR  CONST. SET  PRGM SET  ALARM SET  SYSTEM │
└─────────────────────────────────┘
```

Stands for
"SPEED"

Current transmission speed setting
        192   19200bps
         96   9600bps
         48   4800bps

Stop Bits

Stands for "STOP"

Current stop bit setting
- ⊒ 2bit
- 1 1bit

Data Bits

Stands for "DATA"

Current data bits
- 8 8bit
- 7 7bit

Parity Bits

Stands for "PARITY"

Current parity mode
- EuEn "EVEN" (Even)
- odd "ODD" (Odd)
- non "NONE" (None)

Delimiter

Stands for DELIMITER
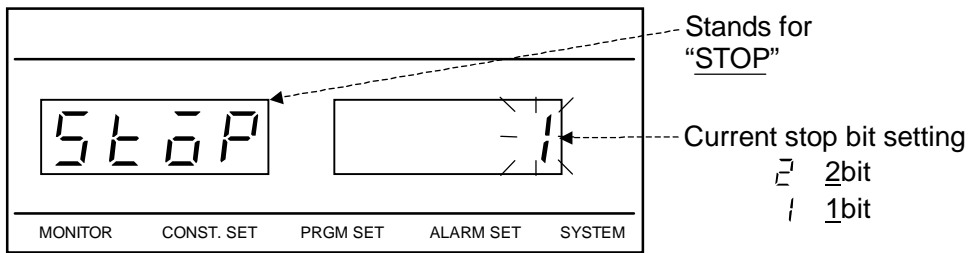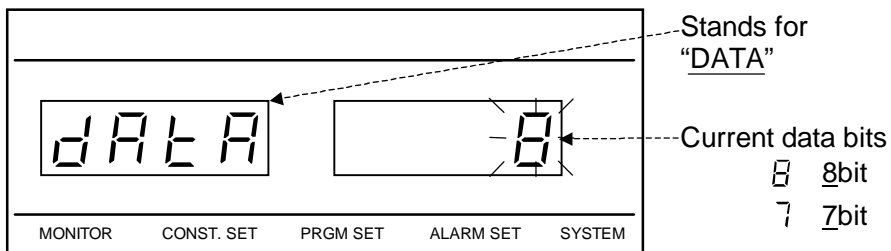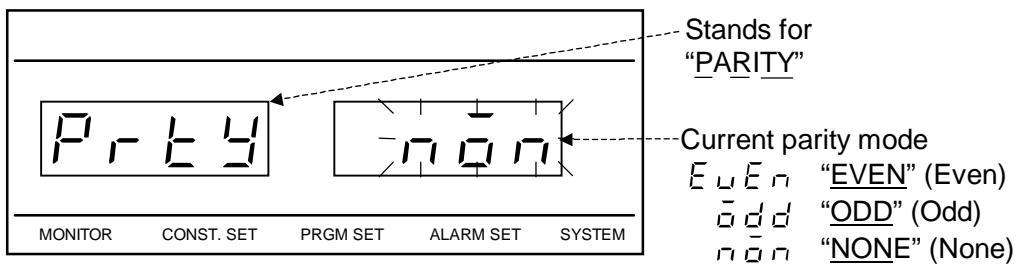
Current delimiter
- C.L "CR+LF"
- L "LF"
- C "CR"
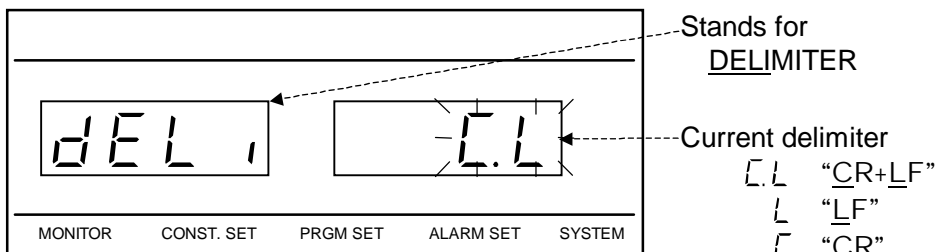
Chapter 3
Commands

This chapter explains setting commands and monitor commands. It provides format, response data and also examples.

3.1 Command List

Monitor commands and setting commands are listed in Tables 3.1 and 3.2 respectively.

Table 3.1 Monitor command list

Command	Description
ROM?	Monitors ROM version.
SRQ?	Monitors SRQ status.
MASK?	Monitors the SRQ status mask setting.
ALARM?	Monitors alarms that have occurred.
KEYPROTECT?	Monitors key lock status.
TYPE?	Monitors chamber information.
MODE?	Monitors chamber operating mode.
MON?	Monitors conditions inside the chamber.
TEMP?	Monitors temperature parameters for the constant mode.
HUMI?	Monitors humidity parameters for the constant mode.
SET?	Monitors refrigerator capacity control setup.
REF?	Monitors refrigerator output.
RELAY?	Monitors time signal ON status.
%?	Monitors heater output.
PRGM MON?	Monitors run status of the current program.
PRGM DATA?	Monitors setup of the program data.
RUN PRGM MON?	Monitors run status of the current remote program.
RUN PRGM?	Monitors setup of the program run from remote.

Table 3.2 Setting command list

Command	Description
MASK	Sets the SRQ status mask.
SRQ	Clears SRQ status.
PRGM ERASE	Deletes programs.
KEYPROTECT	Locks/Unlocks keys.
POWER	Turns control power ON/OFF.
TEMP	Sets temperature.
HUMI	Sets humidity.
SET	Sets refrigerator capacity control.
RELAY	Turns the time signal ON.
PRGM	Controls the current program.
MODE	Sets operating mode.
PRGM DATA WRITE	Edits program data.
RUN PRGM	Creates and starts remote programs.

3.2 Monitor Commands

Monitor commands have the below format.

main command [, optional parameter]

To Monitor ROM Version

Table 3.3 ROM version monitor commands

Monitor command		Description/Example command/Response format/Example response
Main command	**Optional parameter**	
ROM?		Description This command requests the chamber to return the version of the temperature controller ROM.
		Example command "ROM?"
		Response format "ROM type ROM version"
		Example response "JSC-S1.00"

To Monitor Interrupts

Table 3.4 Interrupt monitor command

Monitor command		Description/Example command/Response format/Example response
Main command	Optional parameter	
SRQ?		Description This command requests the chamber to return the SRQ status.
		Example command "SRQ?"
		Response format "SRQ1 SRQ2 SRQ3 SRQ4 SRQ5 SRQ6 SRQ7 SRQ8"

		Example response
		"01000000"
		    SRQ1 : Not in use
		    SRQ2 : "1" is set when a chamber alarm occurs.
		    SRQ3 : "1" is set when step 1 is completed in the remote program
		          mode.
		    SRQ4 : "1" is set when power is turned OFF/ON.
		    SRQ5 : Not in use
		    SRQ6 : Not in use
		    SRQ7 : Reserved for GP-IB communications
		    SRQ8 : Not in use
		
		(Reference)
		
		• Unless the interrupt mask is set with the "MASK" setting command, the concerned SRQ is not set to "1" when the assigned event occurs.
		
		• Once set to "1", SRQ status is held until one of the following occurs.
		        When chamber primary power is turned OFF and ON
		        When the "SRQ, RESET" command is sent
		        When this command is sent with a "01" address attached
		        ("01, SRQ?")

To Monitor Interrupt Mask Bit

Table 3.5 Interrupt mask bit monitor command

Monitor command		Description/Example command/Response format/Example response
Main command	**Optional parameter**	
MASK?		Description This command requests the chamber to return the interrupt mask status.
		Example command "MASK?"
		Response format "SRQ1 SRQ2 SRQ3 SRQ4 SRQ5 SRQ6 SRQ7 SRQ8"
		Example response "01000000" For bit assignment, see "SRQ?".

To Monitor Alarm Status

Table 3.6 Alarm status monitor command

Monitor command		Description/Example command/Response format/Example response
Main command	**Optional parameter**	
ALARM?		Description This command requests the chamber to return the number of alarms that have occurred and their codes.
		Example command "ALARM?"
		Response format "number of alarms occurred [,alarm code] [,alarm code] …"
		Example response "2, 1, 7" • For alarm codes, see the User's Manual -Basic Operation- .

To Monitor Key Lock Status

Table 3.7 Key lock status monitor command

Monitor command		Description/Example command/Response format/Example response
Main command	**Optional parameter**	
KEYPROTECT?		Description This command requests the chamber to return the key lock status.
		Example command "KEYPROTECT?"
		Response format "key lock status"
		Example response "ON" 　　　　When keys are not locked : "OFF" 　　　　When keys are locked :　　"ON"

To Monitor Chamber Information

Table 3.8 Chamber information monitor command

Monitor command		Description/Example command/Response format/Example response
Main command	**Optional parameter**	
TYPE?		Description This command requests the chamber to return the type of sensor, the type of temperature controller and the chamber's highest settable temperature.
		Example command "TYPE?"
		Response format "type of dry-bulb sensor [, type of wet-bulb sensor], type of temperature controller, the chamber's highest settable temperature."
		Example response "T, T, S2, 95.0" • With SU chambers, the type of wet-bulb sensor is omitted from the response.

To Monitor Operating Mode

Table 3.9 Operating mode monitor command

Monitor command		Description/Example command/Response format/Example response
Main command	Optional parameter	
MODE?		Description This command requests the chamber to return the chamber's operating mode.
		Example command "MODE?"
		Response format "operating mode"
		Example response "CONSTANT" • Operating mode is returned as follows. 　　When control power is OFF　　　　　　　　"OFF" 　　When on standby　　　　　　　　　　　　"STANDBY" 　　When in the constant mode　　　　　　　"CONSTANT" 　　When running a program under local control　"RUN" 　　When running a program from remote　　　"RUN"

To Monitor Chamber Conditions

Table 3.10 Chamber conditions monitor command

Monitor command		Description/Example command/Response format/Example response
Main command	Optional parameter	
MON?		Description This command requests the chamber to return the conditions inside the chamber.
		Example command "MON?"
		Response format "monitored temperature [, monitored humidity], operating mode, number of alarms occurred"
		Example response "23.5, 85, CONSTANT, 0" • Operating mode is the same that is returned with the "MODE?" monitor command. • With SU chambers, the monitored humidity is omitted from the response. • The monitored temperature is expressed to one place below the decimal. • The monitored humidity is expressed as a whole number.

To Monitor Constant Mode Temperature Parameters

Table 3.11 Constant mode temperature setup monitor command

Monitor command		Description/Example command/Response format/Example response
Main command	Optional parameter	
TEMP?		Description This command requests the chamber to return the temperature parameters.
		Example command "TEMP?"
		Response format "monitored temperature, target temperature, absolute high limit temperature, absolute low limit temperature"
		Example response "23.0, 85.0, 100.0, 0.0"

To Monitor Constant Mode Humidity Parameters

Table 3.12 Constant mode humidity setup monitor command

Monitor command		Description/Example command/Response format/Example response
Main command	Optional parameter	
HUMI?		Description This command requests the chamber to return the humidity parameters.
		Example command "HUMI?"
		Response format "monitored humidity, target humidity, absolute high limit humidity, absolute low limit humidity"
		Example response "25, 85, 100, 0" • With SU chambers, "NA: CONTROLLER NOT READY – 1" is returned as the response. • If humidity control is OFF, "OFF" is returned for the target humidity.

To Monitor Refrigerator Capacity Control Setup

Table 3.13 Refrigerator capacity control setup monitor command

Monitor command		Description/Example command/Response format/Example response
Main command	**Optional parameter**	
SET?		Description This command requests the chamber to return the refrigerator capacity control setting.
		Example command "SET?"
		Response format "REF code"
		Example response "REF9" • Response differs according to refrigerator capacity control setting, as follows. 　　Auto:　　　　　"REF9" 　　Manual (Fixed):　"REF1" 　　Manual (OFF):　"REF0"

To Monitor Refrigerator Output

Table 3.14 Refrigerator output monitor command

Monitor command		Description/Example command/Response format/Example response
Main command	**Optional parameter**	
REF?		Description This command requests the chamber to return the refrigerator running status.
		Example command "REF?"
		Response format "number of running refrigerators, running status"
		Example response "1, ON1" • Response differs according to refrigerator running status, as follows. 　　When refrigerator is not running: "0" 　　When refrigerator is running:　"1, ON1"

To Monitor Time Signal Output Control

Table 3.15 Time signal output control monitor command

Monitor command		Description/Example command/Response format/Example response
Main command	Optional parameter	
RELAY?		Description This command requests the chamber to return the number of time signals that are ON and their Nos.
		Example command "RELAY?"
		Response format "Number of ON time signals [, time signal No.]"
		Example response "1, 1" ● When the time signal has not been selected as the external output event, "0" is returned as the response.

To Monitor Heater Output

Table 3.16 Heater output monitor command

Monitor command		Description/Example command/Response format/Example response
Main command	Optional parameter	
%?		Description This command requests the chamber to return the number of controllable heaters and their output value.
		Example command "%?"
		Response format "number of heaters, heater output, [, humidifying heater output]"
		Example response "2, 56.2, 38.9" ● With SU chambers, humidifying heater output is omitted from the response. ● The heater output value is expressed to one place below the decimal.

To Monitor Program Run Status

Table 3.17 Program run status monitor command

Monitor command		Description/Example command/Response format/Example response
Main command	Optional parameter	
PRGM MON?		Description This command requests the chamber to return the program parameters for the current program.
		Example command "PRGM MON?"
		Response format "No. of current program, No. of current step, target temperature [, target humidity] , time remaining to step end, number of repeat cycles remaining"
		Example response "1, 2, 27.0, 85, 0:57, 5" • If a program is not running, "NA: CONTROLLER NOT READY – 2" is returned as the response. • This command cannot be used to monitor the remote program mode. • The control targets at the time this command is received by the chamber are returned as the target temperature (humidity). • With SU chambers, the target humidity is omitted from the response. • When temperature (humidity) control is OFF, the response is "No. of current program, No. of current step, OFF[, OFF], time remaining to step end".

To Monitor Program Setup

Table 3.18 Program setup monitor commands

Monitor command		Description/Example command/Response format/Example response
Main command	**Optional parameter**	
PRGM DATA?	PGM : program No.	Description This command requests the chamber to return the setup of the specified program.
		Example command "PRGM DATA?, PGM:1"
		Response format "number of steps, number of repeat cycles, end mode"

		Example response
		"10, COUNT (1. 3. 10), END (HOLD)"
		• This command cannot be used to monitor the remote program mode.
		• If the program contains no data, "NA: DATA NOT READY" is returned as the response.
		• The program number is always "1".
		• The repeat cycle is described as follows.
		    COUNT (1. 3. 10)
		                               — Number of repeat cycles
		                          — No. of repeat cycle end step
		                    — No. of repeat cycle start step
		
		• End mode is returned as follows.
		    When to shut OFF control power at program end "END (OFF)"
		    When to hold the last step at program end "END (HOLD)"
		    When to run the constant mode at program end "END (CONSTANT)"

Cont. from previous page

Monitor command		Description/Example command/Response format/Example response
Main command	Optional parameter	
PRGM DATA?	PGM : program No. STEPxx	**Description** This command requests the chamber to return the setup of the specified step.
		Example command "PRGM DATA?, PGM:1, STEP1"
		Response format "step No., target temperature, temperature ramp control setting [, target humidity, humidity ramp control setting], exposure time setting, guaranteed soak control setting [, REF code] [, ON time signal output]"
		Example response "1, TEMP23.0, TEMP RAMP ON, HUMI50, HUMI RAMP OFF, TIME99:59, GRANTY OFF, REF9, RELAY ON1" • This command cannot be used to monitor the remote program mode. • If the step contains no program data, "NA : DATA NOT READY" is returned as the response. • With SU chambers, the target humidity and humidity ramp control setting are omitted from the response. • If the chamber is not equipped with time signal outputs, the ON time signal output is omitted from the response. • When temperature (humidity) control is OFF for the specified step, the response is "step No., set exposure time ".

To Monitor Remote Program Run Status

Table 3.19 Remote program run status monitor command

Monitor command		Description/Example command/Response format/Example response
Main command	Optional parameter	
RUN PRGM MON?		**Description** This command requests the chamber to return the status of the current remote program.
		Example command "RUN PRGM MON?"
		Response format "number of data sets, target temperature [, target humidity], time remaining to step end, number of repeat cycles remaining"
		Example response "4, 35.9, 85, 1:00, 1" • If a program is not running from remote, "NA: CONTROLLER NOT READY – 2" is returned as the response. • Information on programs run under local control cannot be obtained with this command. • With SU chambers, the target humidity is omitted from the response. • The number of repeat cycles remaining is not currently supported. "1" is automatically set as dummy data.

To Monitor Remote Program Setup

Table 3.20 Remote program setup monitor commands

Monitor command		Description/Example command/Response format/Example response
Main command	**Optional parameter**	
RUN PRGM ?		Description This command requests the chamber to return the setup of the current remote program.
		Example command "RUN PRGM?"
		Response format "start temperature, attainment temperature [, start humidity, attainment humidity], set exposure time, REF code"
		Example response "TEMP 10.0 GOTEMP 30.0 HUMI 50 GOHUMI 80 TIME 1:00 REF9" • Information on programs run under local control cannot be obtained with this command. • With SU chambers, the start humidity and attainment humidity are omitted from the response.

3.3 Setting Commands

Setting commands have the below format.

main command [, optional parameter] , setting data

To Set Interrupt Mask

Table 3.21 Interrupt mask setting command

Setting command			Description/Setting data format/Example command
Main command	**Optional parameter**	**Setting data**	
MASK		mask data	Description This command sets the interrupt mask.
			Setting data format "SRQ1 SRQ2 SRQ3 SRQ4 SRQ5 SRQ6 SRQ7 SRQ8" 　　　SRQ1 : Not in use 　　　SRQ2 : Sets "1" if a chamber alarm occurs. 　　　SRQ3 : Sets "1" when step 1 is completed in the 　　　　　　　remote program mode. 　　　SRQ4 : Sets "1" if power is turned OFF/ON. 　　　SRQ5 : Not in use 　　　SRQ6 : Not in use 　　　SRQ7 : SRQ reserved for GP-IB communications. 　　　SRQ8 : Not in use
			Example command "MASK, 01000000" • Setting this command to "1" enables SRQ status 　setting.

To Reset SRQ Status

Table 3.22 SRQ status reset command

Setting command			Description/Setting data format/Example command
Main command	**Optional parameter**	**Setting data**	
SRQ		resetting command	Description This command clears SRQ status.
			Setting data format "reset command"
			Example command "SRQ, RESET" • This command can also be cleared with the "SRQ?" 　monitor command attached with the 01 address (01, 　SRQ?).

To Delete User Programs

Table 3.23 Program delete command

Setting command			Description/Setting data format/Example command
Main command	**Optional parameter**	**Setting data**	
PRGM ERASE	PGM : program No.		**Description** This command deletes the specified program.
			Setting data format (None)
			Example command "PRGM ERASE, PGM:1" • This command deletes all steps in the specified program. • "1" is the only applicable program No. at present. • If the specified program contains no data, an error is generated when this command is sent. "NA: DATA NOT READY" will be returned as the response.

To Lock/Unlock Keys

Table 3.24 Key lock/unlock commands

Setting command			Description/Setting data format/Example command
Main command	**Optional parameter**	**Setting data**	
KEY PROTECT		ON	**Description** This command locks keys.
			Setting data format "ON"
			Example command "KEYPROTECT, ON" • This command locks out changes to both settings and operation mode. • If chamber control power is OFF, an error is generated when this command is sent. "NA: CONTROLLER NOT READY - 3" will be returned as the response.
		OFF	**Description** This command unlocks keys.
			Setting data format "OFF"
			Example command "KEYPROTECT, OFF" • This command unlocks out changes to both settings and operation mode.

To Turn Power ON/OFF

Table 3.25 Power ON/OFF commands

Setting command			Description/Setting data format/Example command
Main command	Optional parameter	Setting data	
POWER		ON	Description This command turns control power ON. The chamber will start running in the constant mode.
			Setting data format "ON"
			Example command "POWER, ON" ● The chamber cannot be switched to the constant mode while a program is running whether under local or remote control.
		OFF	Description This command turns control power OFF.
			Setting data format "OFF"
			Example command "POWER, OFF"

To Set Temperature

Table 3.26 Temperature setting commands

Setting command			Description/Setting data format/Example command
Main command	**Optional parameter**	**Setting data**	
TEMP		target temperature	Description This command sets or changes the target temperature in the constant mode.
			Setting data format "S target temperature"
			Example command "TEMP, S23.0" • Target temperature can be set between the absolute high and low limit temperatures. • Target temperature data is valid to one place below the decimal. All smaller fractions are ignored.
		high limit temperature	Description This command sets or changes the absolute high limit temperature.
			Setting data format "H high limit temperature"
			Example command "TEMP, H100.0" • High limit temperature can be set between the constant mode target temperature and the chamber's highest settable temperature. • High limit temperature data is valid to one place below the decimal. All smaller fractions are ignored.
		low limit temperature	Description This command sets or changes the absolute low limit temperature.
			Setting data format "L low limit temperature"
			Example command "TEMP, L-20.0" • Low limit temperature can be set between the chamber's lowest settable temperature and the constant mode target temperature. • Low limit temperature data is valid to one place below the decimal. All smaller fractions are ignored.
		target temperature high limit temperature low limit temperature	Description This command sets or changes the constant mode target temperature, absolute high limit temperature and absolute low limit temperature.
			Setting data format "S target temperature H high limit temperature L low limit temperature"
			Example command "TEMP, S23.0 H100.0 L-20.0" • Temperatures must be input in the order of target temperature high limit temperature low limit temperature.

To Set Humidity

Table 3.27 Humidity setting commands

Setting command			Description/Setting data format/Example command
Main command	**Optional parameter**	**Setting data**	
HUMI		target humidity	**Description** This command sets or changes the target humidity in the constant mode.
			Setting data format "S target humidity"
			Example command "HUMI, S85" • Target humidity can be set between the absolute high and low limit humidity. • Target humidity data is treated as a whole number. All numbers below the decimal are ignored. • To turn humidity control OFF, write "HUMI, SOFF". • With SU chambers, an error is generated if this command is sent. "NA: CONTROLLER NOT READY-1" is returned as the response.
		high limit humidity	**Description** This command sets or changes the absolute high limit humidity.
			Setting data format "H high limit humidity"
			Example command "HUMI, H90" • High limit humidity can be set between the constant mode target humidity and the chamber's highest settable humidity. • High limit humidity data is treated as a whole number. All numbers below the decimal are ignored. • With SU chambers, an error is generated if this command is sent. "NA: CONTROLLER NOT READY-1" is returned as the response.
		low limit humidity	**Description** This command sets or changes the absolute low limit humidity.
			Setting data format "L low limit humidity"
			Example command "HUMI, L10" • Low limit humidity can be set between the chamber's lowest settable humidity and the constant mode target humidity. • Low limit humidity data is treated as a whole number. All numbers below the decimal are ignored. • With SU chambers, an error is generated if this command is sent. "NA: CONTROLLER NOT READY-1" is returned as the response.

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Setting command			Description/Setting data format/Example command
Main command	**Optional parameter**	**Setting data**	
HUMI		target humidity high limit humidity low limit humidity	Description This command sets or changes the constant mode target humidity, absolute high limit humidity and absolute low limit humidity.
			Setting data format "S target humidity H high limit humidity L low limit humidity"
			Example command "HUMI, S80 H90 L10" • With SU chambers, an error is generated if this command is sent. "NA: CONTROLLER NOT READY-1" is returned as the response. • Humidity must be input in the order of target humidity high limit humidity low limit humidity .

To Set Refrigerator Capacity Control

Table 3.28 Refrigerator capacity control setting command

Setting command			Description/Setting data format/Example command
Main command	**Optional parameter**	**Setting data**	
SET		REF code	Description This command sets refrigerator capacity control for the constant mode.
			Setting data format "REF code"

			Example command
			"SET, REF9"
			• REF code is as follows.
			    REF9: Auto refrigerator capacity control
			    REF1: Manual refrigerator capacity control
			        (Starting required)
			    REF0: Manual refrigerator capacity control
			        (Stopping required)

To Turn Time Signal Output ON/OFF

Table 3.29 Time Signal output ON/OFF commands

Setting command			Description/Setting data format/Example command
Main command	**Optional parameter**	**Setting data**	
RELAY	ON	Time signal No.	Description This command turns time signals ON for use in the constant mode.
			Setting data format " Time Signal No."
			Example command "RELAY,ON,1" ● When the time signal has not been selected as the external output event, "NA:CONTROLLER NOT READY-4" is returned as the response, but the setting is not changed.
	OFF	Time signal No.	Description This command turns time signals OFF for use in the constant mode.
			Setting data format " Time Signal No."
			Example command "RELAY,OFF,1" ● When the time signal has not been selected as the external output event, "NA:CONTROLLER NOT READY-4" is returned as the response, but the setting is not changed.

To Control Program Running

Table 3.30 Program control commands

Setting command			Description/Setting data format/Example command
Main command	**Optional parameter**	**Setting data**	
PRGM	ADVANCE		Description This command advances the program to the next step.
			Setting data format (None)
			Example command "PRGM, ADVANCE" • If a program is not running, an error is generated when this command is sent. "NA: CONTROLLER NOT READY – 2" is returned as the response. • This command does not work on programs run from remote.
	END	end mode setting	Description This command ends the current program instantly and switches the chamber to the end mode specified here.
			Setting data format "end mode setting"

			Example command
			"PRGM, END, HOLD"
			• If a program is not running, an error is generated when this command is sent. "NA: CONTROLLER NOT READY – 2" is returned as the response.
			• End mode setting is described as follows.
			    To hold the last step at program end :
			        "END, HOLD"
			    To shut OFF the power at program end :
			        "END, OFF"
			    To run in the constant at program end :
			        "END, CONST"
			    To put the chamber on standby at program end :
			        "END, STANDBY"

To Set Operating Mode

Table 3.31 Operating mode setting command

Setting command			Description/Setting data format/Example command
Main command	**Optional parameter**	**Setting data**	
MODE		operating mode	Description This command switches the chamber to the specified operating mode.
			Setting data format "operating mode status"
			Example command "MODE, STANDBY" • Operating mode is expressed as follows. 　　　To turn control power is OFF "OFF" 　　　To set the chamber on standby 　　　　　　　　　　　　　　　　　"STANDBY" 　　　To set the constant mode "CONSTANT" 　　　To run a program "RUN program No." 　　　　　"1" is the only applicable program No. at present. 　　　　　If the specified program contains no data, an error is generated when this command is sent. "NA: DATA NOT READY" will be returned as the response.

To Edit Programs

Table 3.32 Program edit commands

Setting command			Description/Setting data format/Example command
Main command	**Optional parameter**	**Setting data**	
PRGM DATA WRITE	PGM : program No.	edit data	Description This command edits programs.
			Setting data format See table 3.33.
			Example command "PRGM DATA WRITE, PGM: 1, EDIT START" "PRGM DATA WRITE, PGM: 1, STEP1, TEMP10.0, TIME1:00" "PRGM DATA WRITE, PGM: 1, STEP2, HUMI20.0, TRAMP ON TIME 99:59" "PRGM DATA WRITE, PGM: 1, COUNT, (1. 2. 10)" "PRGM DATA WRITE, PGM: 1, END, HOLD" "PRGM DATA WRITE, PGM: 1, EDIT END" • With SU chambers, an error is generated if humidity data is included in this command. • Settings cannot be edited while a program is running.

• The following two edit modes are available for editing programs.

New program mode : Creates a new program. It is necessary to set up steps from step No. 1 forward.

Overwrite mode :   Edits specified steps in existing programs.
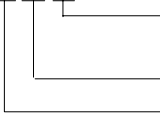
● To create a new program, do the following.

    Set the new program start request.

    Set up steps.

      ● Set up step No. 1.

      ● Set up step No. 2.

            :

      ● Set up repeat counters. (Repeat counters can be omitted.)

      ● Set the end mode. (End mode can be omitted.)

    Set the new program end request.

● To overwrite an existing program, do the following.

    Set the overwrite start request.

    Set up steps.

      ● Set up the target step.

            :

    Set the overwrite end request.

Table 3.33 Request and setting data

Setup request		Description
New program mode requests	new program start	"EDIT START"
	new program end	"EDIT END"
	new program cancel	"EDIT CANCEL"
Overwrite mode requests	overwrite start	"OVER WRITE START"
	overwrite end	"OVER WRITE END"
	overwrite cancel	"OVER WRITE CANCEL"

Step data description		"STEPxx, setup data"
		  "Setup data" is described as follows.
		    Target temperature "TEMPxx.x"
		    Temperature ramp control ON/OFF
		          "TRAMPON" or
		          "TRAMPOFF"
		    Target humidity "HUMIxx"
		    (To turn humidity control OFF, write "HUMI OFF".)
		    Humidity ramp control ON/OFF
		          "HRAMPON" or
		          "HRAMPOFF"
		    Exposure time "TIMExx:xx"
		     Setting range: 00:00 to 99:59 or 100:00 to 999:00 (The number of minutes cannot be set for exposure times over 100 hours.)
		    Guaranteed soak control
		          "GRANTY ON" or
		          "GRANTY OFF"
		    Refrigerator capacity control "REFxx"
		    Time signal ON/OFF "RELAY ON 1 or "RELAY OFF 1."
		Whenever a parameter is omitted, that of the previous step is automatically set.

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Setup request		Description

Other program setup descriptions	repeat counter setup	"COUNT, (x. x. x)"
		                             Number of repeat cycles (1 to 99)
		                   No. of repeat cycle end step
		                   No. of repeat cycle start step
		This setting can be omitted.

	end mode	"END, end mode setting"
		   End mode setting is described as follows.
		      To shut OFF control power at
		      program end "OFF"
		      To hold the last step at program end "HOLD"
		      To run the constant mode at
		      program end "CONSTANT"
		The end mode setting can be omitted. When omitted, "HOLD" is automatically selected.

To Edit Remote Programs

Table 3.34 Remote program edit commands

Setting command			Description/Setting data format/Example command
Main command	Optional parameter	Setting data	
RUN PRGM		edit data	**Description** This command sets up a program to be run from remote. The program is started automatically when setup is complete.
			Setting data format "start temperature attainment temperature [start humidity attainment humidity] exposure time [refrigerator capacity control] [time signal setting]" See Table 3.35.
			Example command "RUN PRGM, TEMP23.0 GOTEMP50.0 HUMI80 GOHUMI100 TIME1:00 " • With SU chambers, an error is generated if humidity data is included in this command.

- The remote program mode enables 1-step programs to be edited, started and stopped from the computer.

- The last step is held at the end of the program.

- Remote program end can be detected by setting the interrupt mask.

- To switch to another mode at the end of the remote program, use the "PRGM" setting command.

Table 3.35 Remote program edit parameters

Control item	Format	Example
Start temperature	"TEMP setting"	"TEMP23.0"
Attainment temperature (Can be omitted.)	"GOTEMP setting"	"GOTEMP35.0"
Start humidity (Can be omitted.)	"HUMI setting"	"HUMI50"
Attainment humidity (Can be omitted.)	"GOHUMI setting"	"GOHUMI80"
Exposure time	"TIME xx : xx"	"TIME23:00"
Refrigerator capacity control (Can be omitted.)	"REF xx"	"REF9"
Time signal ON/OFF (Can be omitted.)	"RELAYON, setting" or "RELAYOFF, setting"	"RELAYON, 1" "RELAYOFF, 1"

- When attainment temperature (humidity) is omitted, the start temperature (humidity) is automatically set.
- When the refrigerator capacity control and time signal settings are omitted, the data from the last program run from remote is set. (The initial refrigerator capacity control setting is "REF9", while that for all time signals is "OFF".)
- Exposure time can be set within the following ranges.
    00:00 to 99:59
    100 to 999
    (The number of minutes cannot be set for exposure times over 100 hours.)

Note
- When waiting for a response, wait to receive that response before sending the next command.
- Include a time lag between command transmissions. Without sufficient processing time, the chamber becomes busy with communications and this can effect operation. This time lag will vary according to command and chamber status, therefore determine how much time is needed according to the environment of use. (As a reference, use a time lag of 0.1 to 1 s.)

Chapter 4
Example Applications

This chapter explains several applications with this communication function, by means of flowcharts. Explanations have been generalized, therefore use the communication function as permitted by your computer, computer language and other communication hardware. Troubleshooting and system protection have been left out of explanations, therefore before use, take what necessary measures you have to deal with system errors.

Note
- Set up communications between the chamber and computer before starting the programs described herein.
- Setting commands may not be properly received by the chamber in certain physical environments because of poor communication quality. Similarly, settings may not be updated if the key lock is ON or because of high or low limit alarms. It is, therefore, recommended to add processing capabilities that resend communications when an "OK: xxx" response is not returned.
- Ensure safety in and around the chamber before starting operation.

4.1   To Monitor Chamber Control Status from Computer

Chamber control status can be monitored from a computer using the monitor commands (see "3.2 Monitor Commands").
The below flowchart shows how to display target temperature and humidity, operating mode and any alarms which have occurred.
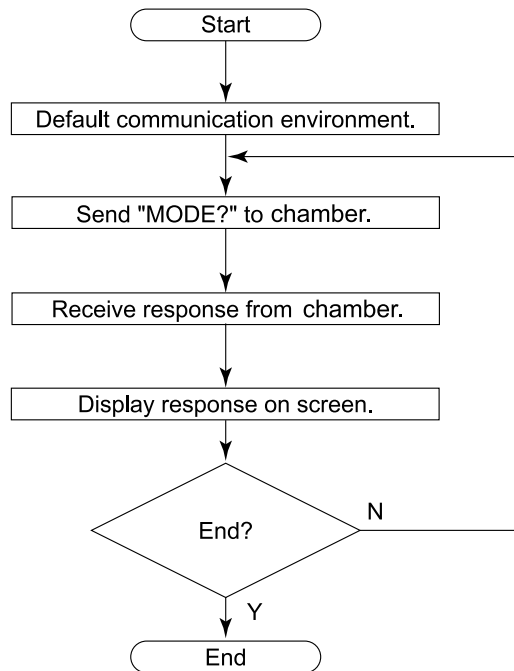
Fig. 4.1 Sample program 1

4.2   To Edit Test Setup from Computer

Test setup can be changed from a computer using the setting commands (see "3.3 Setting Commands").
The below flowchart shows how to set target temperature to 50°C, target humidity to 80% and the constant mode.

```
                    ( Start )
                        |
                        v
        [ Default communication environment. ]
                        |
                        v
        [ Send "TEMP, S50.0" to chamber. ]
                        |
                        v
        [ Receive response from chamber. ]
                        |
                        v
        [ Send "HUMI, S80" to chamber. ]
                        |
                        v
        [ Receive response from chamber. ]
                        |
                        v
        [ Send "MODE, CONSTANT" to chamber. ]
                        |
                        v
        [ Receive response from chamber. ]
                        |
                        v
                     ( End )
```
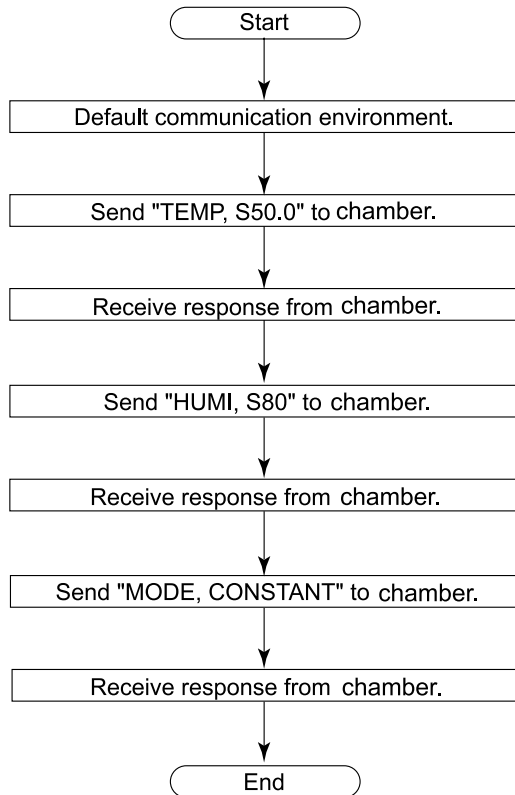
Fig. 4.2 Sample program 2

4.3   To Run Programs from Remote

The "RUN PRGM" command allows only a 1-step program to be run from remote, however in combination with the "SRQ?" interrupt monitor command and "PRGM" program control commands, multiple-step remote programs can be run.

The below flowchart shows how to run a 3-step program from remote and shut OFF control power at program end.

```
                    ┌─────────────┐
                    (    Start    )
                    └─────────────┘
                           │
         ┌─────────────────────────────────────┐
         │   Default communication environment. │
         └─────────────────────────────────────┘
                           │
  ┌──────────────────────────────────────────────────────┐
  │ n = 1                                                  │
  │ Character string [1]  = "RUN PRGM , TEMP10 TIME1:00"   │
  │ Character string [2]  = "RUN PRGM , TEMP20 TIME2:00"   │
  │ Character string [3]  = "RUN PRGM , TEMP30 TIME3:00"   │
  │ Character string [4]  = "PRGM , END, OFF"              │
  └──────────────────────────────────────────────────────┘
                           │
         ┌─────────────────────────────────────┐
         │   Send "MASK, 00100000" to chamber.  │
         └─────────────────────────────────────┘
                           │
         ┌─────────────────────────────────────┐
         │   Receive response from chamber.     │
         └─────────────────────────────────────┘
                           │
         ┌─────────────────────────────────────┐
         │   Send character string [n] to chamber. │
         └─────────────────────────────────────┘
                           │
         ┌─────────────────────────────────────┐
         │   Receive response from chamber.     │
         └─────────────────────────────────────┘
                           │
   Y              ◇ End? ◇
         ┌────────────────── N ────────────────┐
         │   Send "SRQ?" to chamber.            │
         └─────────────────────────────────────┘
                           │
         ┌─────────────────────────────────────┐
         │   Receive response from chamber.     │
         └─────────────────────────────────────┘
                           │
              ◇ Response = "00100000"? ◇   N
                           │ Y
         ┌─────────────────────────────────────┐
         │   Send "SRQ, RESET" to chamber.      │
         └─────────────────────────────────────┘
                           │
         ┌─────────────────────────────────────┐
         │   Receive response from chamber.     │
         └─────────────────────────────────────┘
                           │
         ┌─────────────────────────────────────┐
         │   n = n + 1                          │
         └─────────────────────────────────────┘
                           │
                    ┌─────────────┐
                    (     End     )
                    └─────────────┘
```

Fig. 4.3 Sample program 3

4.4 To Use the SRQ Interrupt in GP-IB Communications

The SRQ interrupt available in GP-IB communications lets you create a higher level of program. (For details on the GP-IB SRQ interrupt, see the manual for GP-IB communications.)

To Monitor Alarms

The "ALARM?" command is available for monitoring alarms which occur with the chamber, but this requires the command to be continually sent to the chamber. The SRQ interrupt uses interrupt processing to detect alarms, thus less load is placed on the system.

```
            ( Start )
                │
    ┌───────────────────────────────┐
    │ Default communication environment. │
    └───────────────────────────────┘
                │
    ┌───────────────────────────────┐
    │  Send "MASK, 01000000" to chamber. │
    └───────────────────────────────┘
                │
    ┌───────────────────────────────┐
    │   Receive response from chamber.   │
    └───────────────────────────────┘
                │
    ┌───────────────────────────────┐
    │         Set SRQ interrupt.         │
    └───────────────────────────────┘
                │
    ┌───────────────────────────────┐
    │        Normal processing        │◄──┐
    └───────────────────────────────┘   │
                │                        │
             ◇ End? ◇ ──N───────────────┘
                │ Y
             ( End )
```

```
    ( SRQ interrupt processing routine )
                │
    ┌───────────────────────────────┐
    │   Polling (To reset SRQ interrupt) │
    └───────────────────────────────┘
                │
    ┌───────────────────────────────┐
    │    Send "SRQ, RESET" to chamber.   │
    └───────────────────────────────┘
                │
    ┌───────────────────────────────┐
    │   Receive response from chamber.   │
    └───────────────────────────────┘
                │
    ┌───────────────────────────────┐
    │      Send "ALARM?" to chamber.     │
    └───────────────────────────────┘
                │
    ┌───────────────────────────────┐
    │   Receive response from chamber.   │
    └───────────────────────────────┘
                │
    ┌───────────────────────────────┐
    │  Processing performed when alarm occurs │
    └───────────────────────────────┘
                │
             ( Return )
```

Fig. 4.4 Sample program 4

Reference │ For SRQ interrupt setup and polling, see the manuals for the GP-IB board and computer language.

To Run Programs from Remote

In the 1-step program in "4.3 To Run Programs from Remote", program end was detected by continually sending the "SRQ?" monitor command to the chamber. But, with the GP-IB SRQ interrupt, it is possible to detect the end of one step and send the next step's data to the chamber by interrupting the computer.

```
                        ( Start )
                           │
         ┌─────────────────▼──────────────────┐
         │   Default communication environment.│
         └─────────────────┬──────────────────┘
                           │
         ┌─────────────────▼──────────────────┐
         │ n = 1                               │
         │ Character string [1]="RUN PRGM, TEMP10 TIME1:00" │
         │ Character string [2]="RUN PRGM, TEMP20 TIME2:00" │
         │ Character string [3]="RUN PRGM, TEMP30 TIME3:00" │
         │ Character string [4]="PRGM, END, OFF"            │
         └─────────────────┬──────────────────┘
                           │
         ┌─────────────────▼──────────────────┐
         │   Send "MASK, 00100000" to chamber. │
         └─────────────────┬──────────────────┘
                           │
         ┌─────────────────▼──────────────────┐
         │   Receive response from chamber.    │
         └─────────────────┬──────────────────┘
                           │
         ┌─────────────────▼──────────────────┐
         │   Send character string [n] to chamber. │
         └─────────────────┬──────────────────┘
                           │                    ◄────┐
         ┌─────────────────▼──────────────────┐      │
         │         Normal processing           │      │
         └─────────────────┬──────────────────┘      │
                           │                          │
                      ╱────▼────╲     N               │
                     ╱  End?     ╲────────────────────┘
                      ╲         ╱
                       ╲───┬───╱
                           │ Y
                        ( End )
```
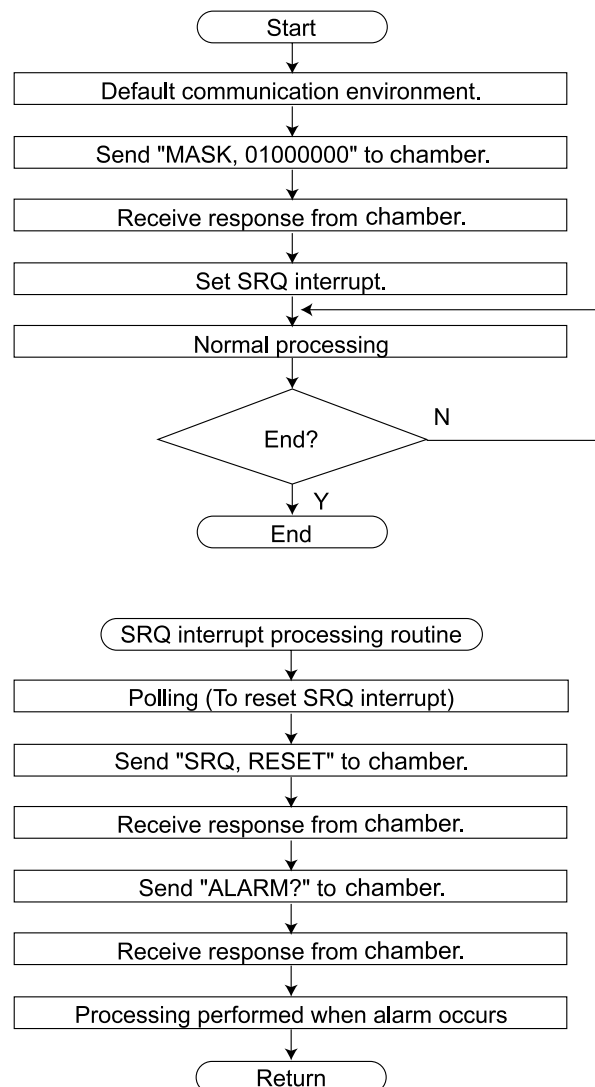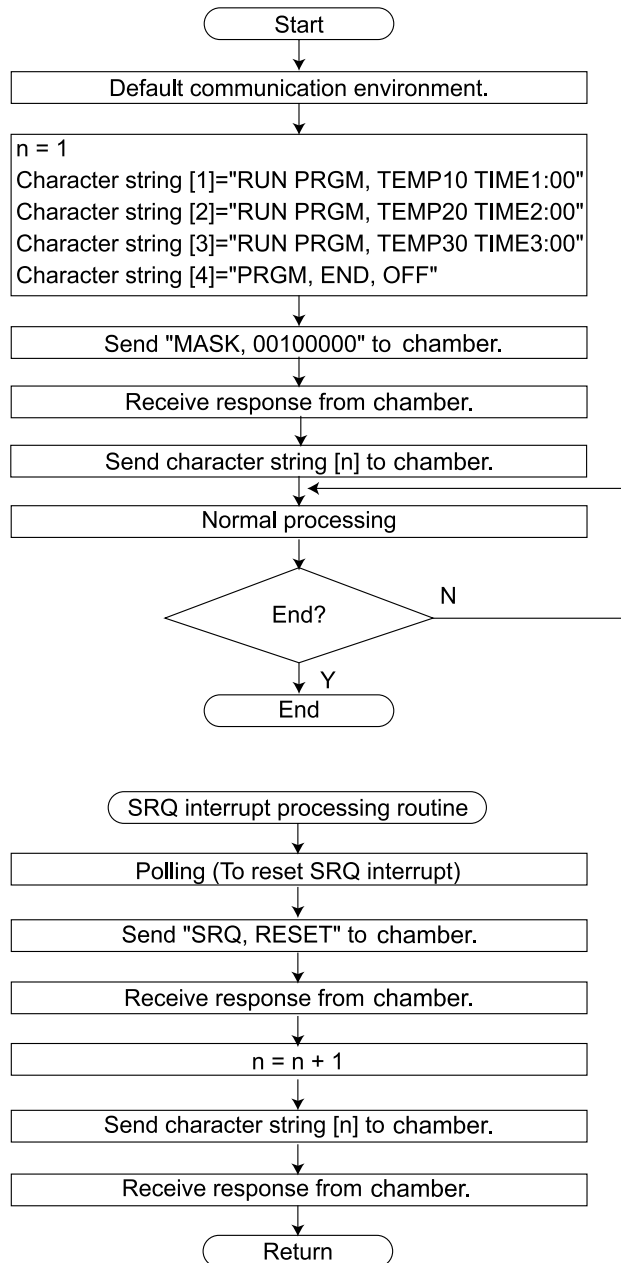
```
              ( SRQ interrupt processing routine )
                           │
         ┌─────────────────▼──────────────────┐
         │   Polling (To reset SRQ interrupt)  │
         └─────────────────┬──────────────────┘
                           │
         ┌─────────────────▼──────────────────┐
         │   Send "SRQ, RESET" to chamber.     │
         └─────────────────┬──────────────────┘
                           │
         ┌─────────────────▼──────────────────┐
         │   Receive response from chamber.    │
         └─────────────────┬──────────────────┘
                           │
         ┌─────────────────▼──────────────────┐
         │              n = n + 1              │
         └─────────────────┬──────────────────┘
                           │
         ┌─────────────────▼──────────────────┐
         │  Send character string [n] to chamber. │
         └─────────────────┬──────────────────┘
                           │
         ┌─────────────────▼──────────────────┐
         │   Receive response from chamber.    │
         └─────────────────┬──────────────────┘
                           │
                       ( Return )
```

Fig. 4.5 Sample program 5

Chapter 5
Specifications

5.1 GP-IB Specifications

Cable and Signal Lines

Cable and signal lines must conform to IEEE standard.

Table 5.1 Pin assignment

Pin No.	Signal	Connection
1	DI01	Connected
2	DI02	Connected
3	DI03	Connected
4	DI04	Connected
5	EOI	Connected
6	DAV	Connected
7	NRFD	Connected
8	NDAC	Connected
9	IFC	Connected
10	SRQ	Connected
11	ATN	Connected
12	Shield	Connected
13	DI05	Connected
14	DI06	Connected
15	DI07	Connected
16	DI08	Connected
17	REN	Connected
18	DAV ground	Connected
19	NRFD ground	Connected
20	NDAC ground	Connected
21	IFC ground	Connected
22	SRQ ground	Connected
23	ATN ground	Connected
24	EOI and REN ground	Connected

Address

Address can be selected from 1 to 16 and changed from the instrumentation panel. It is not necessary to restart the system after changing the address.

Interface Support

Table 5.2 Interface support

Function	Level	Remarks
Source handshake	SH1	• Contains all source handshake capabilities.
Acceptor handshake	AH1	• Contains all acceptor handshake capabilities.
Talker	T6	• Basic talker • Serial poll • Does not have talk only. • MLA talker cancel
Listener	L4	• Basic listener • Does not have listen only. • MTA listener cancel
Service request	SR1	• Service request
Remote-Local	RL2	• Contains all remote-local functions except local lockout. (However, does not support GTL address command.)
Parallel poll	PP0	• Does not have parallel poll.
Device clear	DC1	• Contains all device clear functions. However, operates as in IFC reception.
Device trigger	DT0	• Does not have device trigger.
Controller	C0	• Does not have system controller. • Does not have IFC send/controller-in-charge. • Does not have REN send. • Does not have SRQ response. • Does not have interface message. • Does not have control receive. • Does not have control relinquish. • Does not have self control receive/relinquish. • Does not have parallel poll. • Does not have control receive/relinquish in synch with handshake.

Control Bus Support

Table 5.3 Control bus support

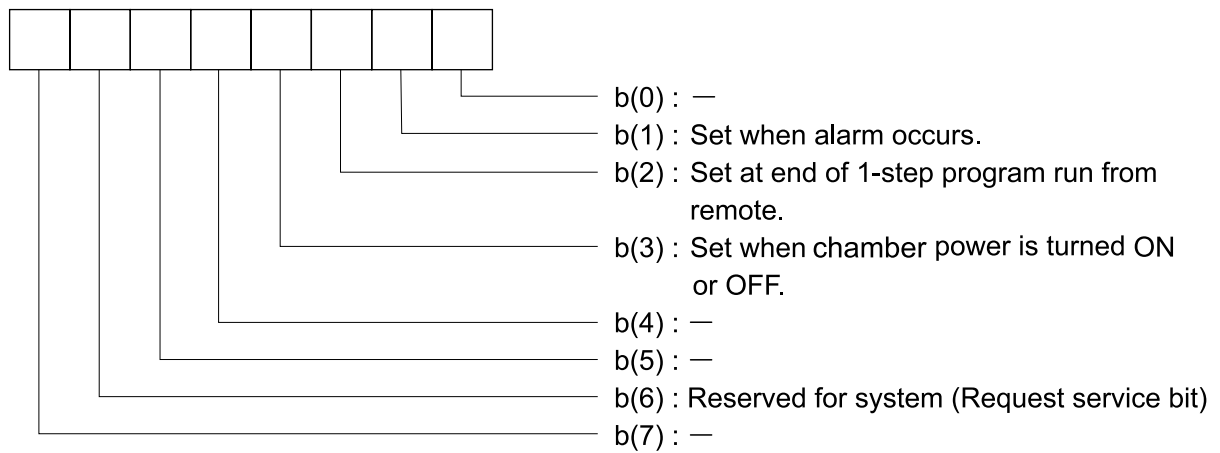| Control bus	Support	Remarks
ATN	Supported	Conforms to IEEE488.
IFC	Supported	Conforms to IEEE488.
SRQ	Supported	Conforms to IEEE488. (Supports serial poll but not parallel poll.)
EOI	Supported	Conforms to IEEE488.

Universal Command Support

Table 5.4 Universal command support

Command	Support	Remarks
LLO	Not supported	Basically, to make communication control unconditional when communications are enabled.
DCL	Supported	Operates the same as in IFC reception.
PPU	Not supported	Does not support parallel poll therefore PPU support is unnecessary.
SPE	Supported	Supports SRQ, therefore SPE support is necessary.
SPD	Supported	Supports SRQ, therefore SPD support is necessary.

Address Command Support

Table 5.5 Address command support

Command	Support	Remarks
GTL	Not supported	
SDC	Supported	Confirms to IEEE488.
PPC	Not supported	Does not support parallel poll, therefore PPC support is unnecessary.
GET	Not supported	Basically, to make communication control unconditional when communications are enabled.
TCT	Not supported	Because does not have controller (domain controller) capabilities.

Fig. 5.1 SRQ serial poll register

b(0) : ―
b(1) : Set when alarm occurs.
b(2) : Set at end of 1-step program run from remote.
b(3) : Set when chamber power is turned ON or OFF.
b(4) : ―
b(5) : ―
b(6) : Reserved for system (Request service bit)
b(7) : ―

5.2 RS-232C Specifications

Cable and Signal Lines

The cable must conform to JIS (Japanese Industrial Standards) –X5101. Use a straight cable for signal (modem) connections.

Table 5.6 RS-232C pin assignment

Pin No.	Signal (JIS)	Signal	Connection
1	FG	Protective ground or cable shield	Not connected
2	SD (T x D)	Transmission data	Connected
3	RD (R x D)	Reception data	Connected
4	DR (DSR)	Data set ready	Connected
5	SG	Signal line ground	Connected
6	ER (DTR)	Data terminal ready	Connected
7	CS (CTS)	Transmission enabled	Connected
8	RS (RTS)	Send request	Connected
9	GND	Ground	Not connected

Connection Example
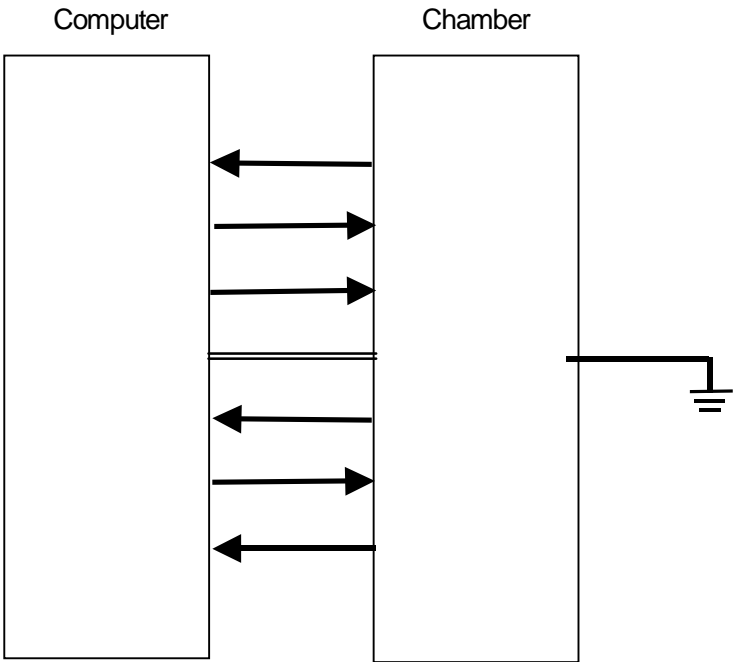
Communication System

Synchronized modulated full-duplexing

Transmission Rate

Selectable from 4800, 9600 and 19200 bps. Can be selected from the instrumentation panel. It is not necessary to restart the system after changing the transmission rate.

Data Bit

Data length	7/8
Stop bits	1/2
Parity check	None/Even/Odd

Can be selected from the instrumentation panel. It is not necessary to restart the system after changing the transmission rate.

Flow Control

Xon/Xoff control	OFF
Si/So control	OFF

The above setting cannot be changed by users.

Local Echo

Not supported

User's Manual

Bench-Top Type Temperature and Humidity Chamber

Option
Communication Function GP-IB/RS-232C

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