OPERATION MANUAL

GP-IB INTER FACE

IB11-PCR-L

RS-232C INTER FACE

RS11-PCR-L

KIKUSUI

Part No. Z1-000-352, IA000497

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IB11/RS11-PCR-L

This manual applies to the GP-IB Interface IB11-PCR-L or RS-232C Interface RS11-PCR-L connected to a PCR-L AC Power Supply with ROM version 1.00 or higher. When you inquire about the product, be prepared to provide us with the following information.

- PCR-L AC Power Supply model number
- PCR-L AC Power Supply ROM version
- PCR-L AC Power Supply serial number and revision number (indicated on the lower rear part of the equipment)
- GP-IB Interface/RS-232C Interface model number
- GP-IB Interface/RS-232C Interface serial number and revision number

* Before using the GP-IB Interface or RS-232C Interface, be sure to read the PCR-L AC Power Supply Operation Manual.
- Do not use or mount a substitute or attempt to modify the GP-IB Interface/RS-232C Interface.
- The GP-IB Interface/RS-232C Interface uses no parts that can be replaced by the customer.

Warning and Precaution Symbols Indicated in this Operation Manual

Tho following symbols are indicated where special caution is required in handling the GP-IB Interface/RS-232C Interface.

Symbol	Description
WARNING	Indicates the existence of a personnel hazard. • Always follow the proper operating procedure. Incorrect operating procedures may result in personal (bodily) injury. • Do not proceed beyond a WARNING sign until the indicated conditions are fully understood and met.
Caution	Indicates the existence of a hazard. • Always follow the applicable operating procedure. Incorrect operating procedures may damage the GP-IB Interface/RS-232C Interface or other equipment. • Do not proceed beyond a Caution sign until the indicated conditions are fully understood and met.

CONFIGURATION OF THE OPERATION MANUAL

This operation manual is configured as follows:

Chapter 1	GENERAL Describes the features of the GP-IB Interface/RS-232C Interface and preparation for use.
Chapter 2	INSTALLATION IN A PCR-L AC POWER SUPPLY Describes how to install the GP-IB Interface/RS-232C Interface in a PCR-L AC Power Supply.
Chapter 3	INITIAL SETTING Explains how to accomplish the initial setting required for using the GP-IB Interface/RS-232C Interface.
Chapter 4	BASIC KNOWLEDGE Presents basic information about of various messages needed to understand the GP-IB Interface/RS-232C Interface commands.
Chapter 5	COMMAND DESCRIPTION Describes command functions and formats.
Chapter 6	SPECIFICATIONS Shows the specifications of the GP-IB Interface/RS-232C Interface.
APPENDIX	Contains the power line abnormality simulation setting sheet, sequence operation setting sheet, and quick command reference sheets.

TABLE OF CONTENTS

Chapter 1
GENERAL

Describes the features of the GP-IB Interface/RS-232C Interface and preparation for use.

Contents Page

1.1 Outline

This device (IB11-PCR-L/RS11-PCR-L) is an interface board for the PCR-L Series AC Power Supplies. The IB11-PCR-L is an interface board for GP-IB communications; the RS11-PCR-L is an interface board for RS-232C communications. Use of the IB11-PCR-L/RS11-PCR-L with a PCR-L AC Power Supply significantly extends the PCR-L Series AC Power Supply functions.

1.2 Features

Using the IB11-PCR-L/RS11-PCR-L allows the PCR-L AC Power Supplies to utilize the following enhanced functions in addition to the PCR-L AC Power Supply's standard functions.

(1) **Power line abnormality simulation (power line interruption simulation)**
This function enables simulation of power failure, fast voltage decrease (DIP), or fast voltage increase (POP). The function is useful to test switching power supplies or microprocessor-based devices.

(2) **Sequence operation**
Sequence operation permits automatic operation by combining output voltage and frequency or other parameters with duration time. This function can be used to test the power supply environment of a variety of devices and equipment.

(3) **Harmonic current analysis function**
Harmonic current analysis is available for output current. The conventional approach uses an FFT analyzer for measurement. The PCR-L AC Power Supplies, however, do not require an FFT analyzer. This function can be used for harmonic current analysis of various equipment.

(4) **Special waveform output**
This function can allow the waveforms other than a sine wave. This function allows the " peak clipped waveform, " in which the peak of a sine wave is suppressed, to be output as standard.

Transferring waveform data to the GP-IB Interface/RS-232C Interface allows a user-defined waveform to be output.

This function can be used in chemical experiments and for production equipment.

(5) **Output impedance setting**

The PCR-L AC Power Supplies have almost 0 Ω output impedance (output resistance); an actual commercial power line has several mΩ to several Ω impedance (resistance). When the GP-IB Interface/RS-232C Interface is connected to a PCR-L AC Power Supply, the PCR-L AC Power Supply can vary the output impedance. This allows simulation of an environment similar to that of an actual commercial power line.

The set values are backed up inside the PCR-L AC Power Supply. Therefore, the PCR-L Power Supply can operate in the same condition continuously even if the device is removed, as long as the setting conditions remain the same.

(6) **Measurements of power-factor, VA, and peak holding current**

The diverse measurement functions of the PCR-L AC Power Supplies can be extended by connecting the GP-IB Interface/RS-232C Interface. The additional functions include the measurement of power-factor, VA, and the peak holding current.

The peak holding current measurement function is useful for measuring a rush current, since a peak current can be measured until the PCR-L AC Power Supply receives a peak clear signal or command.

(7) **Output ON/OFF phase setting**

Output ON/OFF phase setting is available separately. This function is used when output ON/OFF phase setting is required.

The set values are backed up inside the PCR-L AC Power Supply. Therefore, the PCR-L AC Power Supply can operate in the same condition continuously even if the device is removed, as long as the setting conditions remain the same.

(8) **AC + DC mode**

This function allows the PCR-L AC Power Supply to output voltage waveforms in which AC voltage is superimposed on DC voltage. The function can be used in chemical experiments and for production equipment.

(9) Expansion of the Memory Function

The PCR-L AC Power Supplies allow nine sets of voltage and frequency settings to be stored as standards in the memory, enabling the data to be read for output as necessary. Connecting the GP-IB Interface/RS-232C Interface enables the equipment to store up to 99 sets of voltage and frequency set values.

To output read a set value (or set values) stored using the GP-IB Interface/ RS-232C Interface, use the PCR-L AC Power Supply or RC02-PCR-L Remote Controller. The GP-IB Interface/RS-232C Interface has only input (write) capability.

1.3 Preparation for Using the GP-IB Interface/RS-232C Interface

The following hardware and software are needed to use the GP-IB Interface/RS-232C Interface:

① A computer to control the GP-IB Interface/RS-232C Interface (such as a personal computer or workstation)
② An RS-232C interface cable (crossed type) (for RS11-PCR-L)
③ A GPIB interface cable (for IB11-PCR-L)

Chapter 2

INSTALLATION IN A PCR-L AC POWER SUPPLY

Describes the installation procedure.

Contents

2.1 Check at Unpacking

The GP-IB Interface/RS-232C Interface was carefully tested and inspected, both mechanically and electrically, before shipment to ensure its normal operation. Check the device upon receipt for damage that might have occurred during transportation. Also, check that all items listed in the table below have been provided.

If the device appears to be damaged or if any accessory is missing, notify your Kikusui agent.

■ IB11-PCR-L

Items	Q'ty	Check
IB11 interface board	1	
Mounting screws (M3)	2	
Operation Manual	1	

■ RS11-PCR-L

Items	Q'ty	Check
RS11 interface board	1	
Mounting screws (M3)	2	
Operation Manual	1	

2.2 GP-IB Interface/RS-232C Interface Handling Precautions

Always observe the following cautions in handling the GP-IB Interface/RS-232C Interface board, since its PCB is exposed.

- Never touch any of the electronics parts installed on the PCB.
- Never handle the interface board under conditions where static electricity might accumulate.
- After unpacking the GP-IB Interface/RS-232C Interface carton, promptly install the GP-IB Interface/RS-232C Interface in a PCR-L AC Power Supply.
- When storing the GP-IB Interface/RS-232C Interface board, always take measures to prevent static electricity, such as storing it in the bag used for the packing.
- Do not drop the board or subject it to other impact.
- Do not place the board where it could be exposed to water or other liquid.

2.3 Combination with Other Options

The PCR-L Series has various other optional interface boards in addition to the GP-IB Interface/RS-232C Interface. Only one interface board can be installed in the PCR-L AC Power Supply slots. Also, note that an interface board cannot be used simultaneously with the RC02-PCR-L Remote Controller. One of the IB11-PCR-L and RS11-PCR-L can be installed together with the Remote Controller in the PCR-L AC Power Supply slots, but they cannot be operated simultaneously .

Caution Only one interface board can be inserted and operated in the PCR-L AC Power Supply slots.

2.4 Installing the GP-IB Interface/RS-232C Interface Board into a PCR-L AC Power Supply Slot

This interface board (IB11 or RS11) can be inserted into some of the PCR-L AC Power Supply extension slots. The table below shows the slots available for the GP-IB Interface/RS-232C Interface. Any of the slots marked with a circular mark allows the same functions.

Extension slot numbers	IB11	RS11
SLOTl (Left of the PCR-L AC Power Supply control panel)	O	O
SLOT2 (Upper rear part of a PCR-L AC Power Supply)	X	O
SLOT3 (Upper rear part of a PCR-L AC Power Supply)	O	O
SLOT4 (Upper rear part of a PCR-L AC Power Supply)	X	X
SLOT5 (Upper rear part of a PCR-L AC Power Supply)	X	X

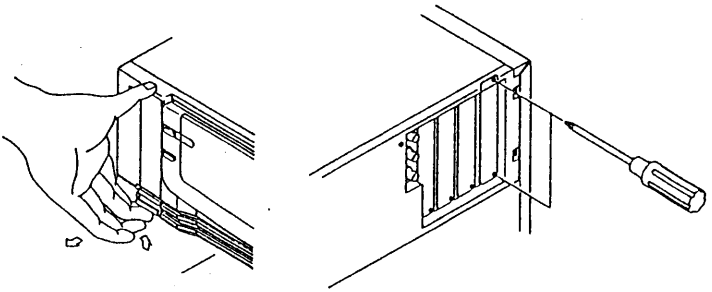
O: Mountable

X: Not mountable

Installation Procedure

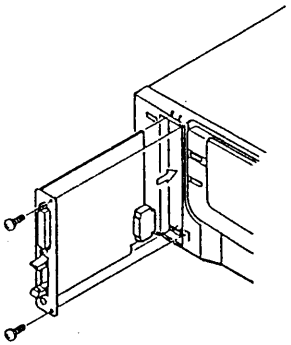
Caution Before installing the GP-IB Interface/RS-232C Interface, always turn OFF the POWER switches of the PCR-L AC Power Supply and the computer that controls the GP-IB Interface/RS-232C Interface.

Step 1 Remove a slot cover.



Step 2 Hold the panel part of the GP-IB Interface/RS-232C Interface board.

Step 3 Orient the interface board so that the parts-mounted side of the PCB is at the right, and place the PCB into the slot grooves.



Step 4 Carefuly insert the interface board along the slot grooves all the way so that the connector is coupled.

Step 5 Fix the interface board to the PCR-L AC Power Supply using the screws provided.

This completes installation of the GP-IB Interface/RS-232C Interface.

2.5 Connecting the GP-IB Interface/RS-232C Interface Cable

Before connecting the interface cable, always turn OFF the POWER switches of the PCR-L AC Power Supply and the computer that controls the GP-IB Interface/RS-232C Interface.

Match the orientation of the interface cable plug to that of the GP-IB Interface/RS-232C Interface connector.

2.6 Moving Precautions

Caution

- Moving a PCR-L AC Power Supply with the interface cable connected to the GP-IB Interface/RS-232C Interface may place unreasonable stress on the cable. Before moving the PCR-L AC Power Supply, always disconnect the interface cable from the device.
- When moving the PCR-L AC Power Supply, follow the instructions given in the PCR-L AC Power Supply Operation Manual due to its heavy weight.

Chapter 3
INITIAL SETTING

Use of the GP-IB Interface/RS-232C Interface requires initial setting of the PCR-L AC Power Supply control panel.
This chapter describes how to accomplish the initial setting.

Contents

3.1 GP-IB Interface Board (IB11-PCR-L)

Before of the GP-IB Interface board (IB11-PCR-L) can be used, the GPIB address and response message terminator must be set. The setting done prior to factory shipment is as shown below. To set any values other than those below, follow the procedures in subsections 3.1.1 and 3.1.2.

Setting done prior to factory shipment
GPIB address: 1
Response message terminator: CRLF + EOI

3.1.1 Setting the GPIB Address

This subsection describes how to set the IB11-PCR-L GPIB address.

GPIB Address Setting Procedure

- Set the GPIB address with the GP-IB Interface installed in a PCR-L AC Power Supply.

Shift key operation
In this manual, key operations that require pressing of the SHIFT key are denoted as follows:
SHIFT + F (GP-IB) ..... Indicates that you should press SHIFT (which lights the SHIFT indication on the control panel) and then F. (This selects the GPIB function.)

Step 1 Press ESC to call the Home Position.

Step 2 Press SHIFT + F (GP-IB). This causes a numeric value to appear in the control panel frequency display area and "GP-IB ADRS" to light at the left of the value. The numeric value in the frequency display area indicates the GPIB address.

Step 3 Use the numeric keys to set the GPIB address (0 to 30).

Step 4 Press ENT to fix the address.

Step 5 Press ESC.

- The GPIB address that has been set becomes valid after turning ON the PCR-L AC Power Supply POWER switch again.

3.1.2 Setting the Response Message Terminator (Delimiter)

The response message terminator (delimiter) is sent by the GP-IB Interface at the end of a response message to inform the GPIB controller that the response message is finished.

Response Messsage Terminator Setting Procedure

Step 1 Press ESC to call the Home Position.

Step 2 Press SHIFT + F (GP-IB) twice. This causes a numeric value to appear in the control panel frequency display area and "GPIB DLIM" to light at the left of the value. The numeric value in the frequency display area indicates the GPIB delimiter. The relationship between value and delimiters is as shown in the table below.

Numeric value	Delimiter	
0	CRLF + EOI	← (Setting at factory shipment)
1	CR + EOI	
2	LF + EOI	
3	EOI	

CR : Carriage Return
LF : Line Feed
EOI : End or Identify

Step 3 Use the numeric keys, JOG, or SHUTTLE to set the delimiter.

Step 4 Press ESC.

- The response message terminator that has been set becomes valid after turning ON the PCR-L AC Power Supply POWER switch again. The response message terminator is also described in [TERM] in subsection 5.1, System Commands.

[Description] Setting of the command message terminator, which is a command termination symbol that the GP-IB Interface receives from the GPIB controller, is not normally required. For details, see 4.1.4, Command Message Terminator (Delimiter).

3.2 RS-232C Interface Board (RS11-PCR-L)

Before the RS-232C Interface board can be used, communication parameters must match those of the computer and a response message terminator must be set. The setting done prior to factory shipment is as shown below. To set any values other than those below, follow the procedures in subsections 3.2.1 and 3.2.2.

Setting at factory shipment

Communication parameters	:	Baud rate	:	9600 bps
		Stop bit	:	One bit
		Data length	:	Eight bits
		Parity	:	None
Response message terminator	:	CRLF		

3.2.1 Setting the RS-232C Communication Parameters

This subsection describes how to set the RS11-PCR-L RS-232C communication parameters.

RS-232C Communication Parameter Setting Procedure

- Set the RS-232C communication parameters with the RS-232C Interface installed in a PCR-L AC Power Supply.

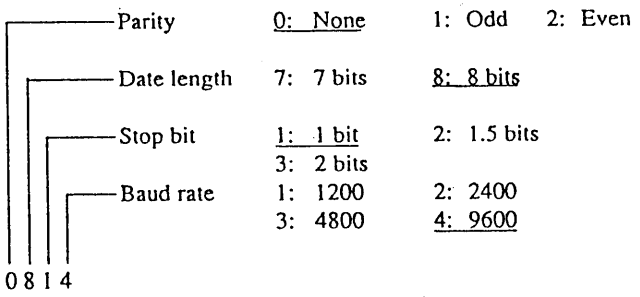
Shift key operation
In this manual, key operations that require pressing of the SHIFT key are denoted as follows:
SHIFT + F (GP-IB) ..... Indicates that you should press SHIFT (which lights the SHIFT indication on the control panel) and then F. (This selects the GPIB function.)

Step 1 Press ESC to call the Home Position.

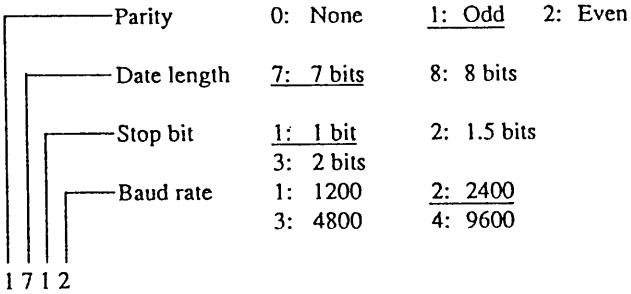
Step 2 Press SHIFT + F (GP-IB).

This causes a four-digit numeric value to appear in the control panel frequency display area. This value indicates the RS-232C communication parameters.

- The setting at the factory shipment is 0814.



Step 3 Use the numeric keys to set the communication parameters as a four-digit numeric value. For example, to set the baud rate to 2400, stop bit to 1 bit, data length to 7 bits, and parity to odd number, the following numeric should be accomplished.



Step 4 Press ENT to fix the setting, then press ESC.

- The RS-232C communication parameters that have been set become valid after turning ON the PCR-L AC Power Supply POWER switch again.

3.2.2 Setting the Response Message Terminator (Delimiter)

The response message terminator (delimiter) is sent by the RS-232C Interface at the end of a response message to inform the RS-232C terminal that the response message is finished. The response message terminator can be set to one of the following alternatives.

CRLF (setting at factory shipment)
CR
LF

The response message terminator cannot be set from the PCR-L AC Power Supply control panel. Setting of the response message terminator requires the [TERM] command.

For the [TERM] command, see [TERM] in section 5.1, System Commands.

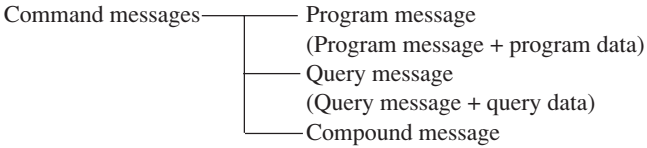
Chapter 4
BASIC KNOWLEDGE

Explains the terms used in this Operation Manual.

Contents

4.1 Command Messages

A command (ASCII code character string) sent from the GP-IB controller or RS-232C terminal to the GP-IB Interface/RS-232C Interface is called a “command message.” Command messages include the following three types.



- Either uppercase or lowercase letters can be used.

- By suffixing a "@" at the end of a program message or a query message, the GP-IB can be held off until the execution of the message is complete. However, in the event of a command message terminator with only EOI, use "@@".
  The hold-off function is peculiar to the GP-IB interface board (IB11-PCR-L).

[Description] Symbols denoting data used in this Operation Manual are listed in the table below.

Symbol	Data type
NR1	1 (ON) / 0 (OFF)
NR2	Decimal
NR3	Hexadecimal
NR4	Real number
string	Alphanumeric characters (control code not allowed)
sp	Space code (20H)
?	Character “?” (3FH)
,	Character “,” (2CH)

4.1.1 Program Messages

Program messages are various commands used to operate the GP-IB Interface/RS-232C Interface. A program message consists of a header (leading command) and data. The header used for a program message is called a "program header," and the data used for a program message is called "program data."

The program header is delimited from program data by a space (ASCII code 20H). For a program message consisting of multiple program data, each item of program data is delimited by "," (comma). Do not use other characters (such as a space) between letters in the program header.

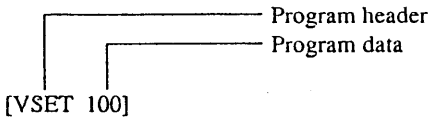
[Program header] [SP] [Program data](, [Program data] ....)

Program message commands (from the controller to the GP-IB Interface/RS-232C Interface) have either format ① or ② below.

① [Program header]
② [Program header] [SP] [Program data](, [Program data] ....)

[SP] represents a space (ASCII code 20H).
( ) indicates data that can be omitted.
.... indicates data that can be repeated.

Example: To set 100 V output voltage using the [VSET] command



- The GP-IB Interface/RS-232C Interface accepts integer, decimal, and exponential data as real number program data.
  Example: Integer 100
  Decimal 100.0
  Exponential ..... 1.0E + 2
- The following units can be identified.
  Voltage: kV, V, mV ([V] for default)
  Time: S, mS, μS ([S] for default)

4.1.2 Query Messages

A query message is a command used to obtain return information from the GP-IB Interface/RS-232C Interface relating to the internal operation of the PCR-L AC Power Supply. A query message consists of a header (leading command) and data. The header and data used for query messages are called "query header" and "query data" respectively. Some query messages have no query data.

When the GP-IB Interface/RS-232C Interface receives a query message, the device returns a response message to the GPIB controller or RS-232C terminal. Query messages always end with "?" (question mark). Do not use any other character (such as a space) between header letters.

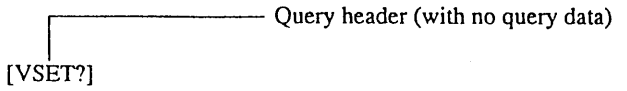
[Query header] [SP] [Query data] ([SP] [Query data] ....) [?]

Query message commands (from the controller to the GP-IB Interface/RS-232C Interface) have either format ① or ② below.

① [Query header] [?]
② [Query header] [SP] [Query data] ([SP] [Query data] ....) [?]

[SP] represents a space (ASCII code 20H).
( ) indicates data that can be omitted.
.... indicates data that can be repeated.

Example: To obtain an output voltage set value using the [VSET?] command



Response to the [VSET?] command (from the GP-IB Interface/RS-232C Interface to GPIB controller/RS-232C terminal)
For a voltage set value of 100 V . . . [VSET 100.0V]

4.1.3 Compound Messages

A compound message is a command message consisting of multiple program messages, or one query message and one or more program messages. Each message is delimited by ";" (semicolon).

Compound messages (from the controller to the GP-IB Interface/RS-232C Interface) have either format ① or ② below.

① [Program message] [;] [Program message] ([;] [Program message] ....)
② [Query message] [;] [Program message] ([;] [Program message] ....)

Example: To set up operation for outputting an output voltage of 100 V using a compound message
[VSET 100;OUT ON]
This compound message is similar to sending program messages [VSET 100] and [OUT ON] in succession.

4.1.4 Command Message Terminator

The GPIB controller or RS-232C terminal should send a command message terminator as a termination symbol to the GP-IB Interface/RS-232C Interface to inform the interface of completion of the command message. The command message terminator must always be sent at the end of a command message.

The command message terminator is also called a "delimiter." The GP-IB Interface/RS-232C Interface allows use of one of the following formats ① to ④ as the command message terminator.

① CRLF + EOI
② CR + EOI
③ LF + EOI
④ EOI

CR : Carriage Return
LF : Line Feed
EOI : End or Identify

- EOI is assigned only for GPIB communication. RS-232C communication uses no EOI.

4.2 Response Message

After receiving a query message, the GP-IB Interface/RS-232C Interface sends a response message. A response message is an ASCII code character string consisting of header and numerics. ASCII code characters are all uppercase. The response message header is called a "response header," and the response message data is called a "response data."

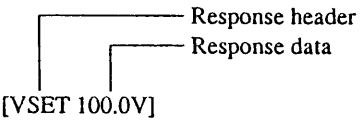
[Response header] [SP] [Response data]

A response message has either format ① or ② below.

① [Response header]
② [Response header] [SP] [Response data]

[SP] represents a space (ASCII code 20H).

Example: Response to the [VSET?] command (from the GP-IB Interface to GPIB controller)
For a voltage set value of 100 V .....



4.3 Acknowledgement Message (RS-232C)

An acknowledgement message is information (ASCII code character string) sent by the RS-232C Interface to inform the RS-232C terminal of completion of program message processing. The acknowledgement message consists of only a header.

[Description]
- Acknowledgement messages are specific to the RS-232C Interface board (RS11-PCR-L) only.
- The following two acknowledgement messages are available.
  "OK".... Normal termination
  "ERROR" .... Occurrence of an error such as a syntax error
- The acknowledgement message function can be set ON/OFF using the [SILENT] command.

4.4 Flow Control (RS-232C)

Use of X ON/X OFF allows control of RS11-PCR-L sending and receiving. This control is accomplished using the DC (device control) code.

Function	ISO. EIA
Send request (XON)	DC1 (11H)
Send stop request (XOFF)	DC3 (13H)

- Control of sending from the RS11-PCR-L to the RS-232C terminal
  Suspension should occur within three characters after DC3 has been received.
- Control of sending from the RS-232C terminal to the RS11-PCR-L
  Suspension should occur within 10 characters after DC3 has been received.

[Description] Send and receive control should be accomplished using the flow control or acknowledgement message function. Use of other means may result in sending and receiving incorrect data.

Chapter 5
COMMAND DESCRIPTION

Describes the function and format of a variety of commands.

Contents

5.1 System Commands

5.1.1 Setting the Provision of Response Header ([HEAD])

The [HEAD] command allows selection of whether a set of the response header and letter(s) indicating the unit of response data is assigned.

[HEAD] command	Response header and unit
[HEAD 1] [HEAD ON]	Assigned
[HEAD 0] [HEAD OFF]	Not assigned

(Setting at factory shipment)

- Use the [HEAD?] command to determine whether the response header is assigned.
- If the response data obtained by the [HEAD?] command is [001], the response header is assigned. If [000], no response header is assigned.

Example: Response to the [ACVSET?] command (from the GP-IB Interface to GPIB controller)

For a voltage set value of 100 V . . . . . [ACVSET 100.0V]
After the GP-IB Interface has received the [HEAD 0] or [HEAD OFF] command . . . . [100.0]

The sample programs given in this chapter show programming examples using an NEC PC-9801 series personal computer.

Sample program (for IB11-PCR-L)

```
:
100 ADR = 1                              'IB11-PCR-L address
110 ISET IFC;ISET REN : CMD DELIM=0  'Initializes PC-9801.
120 PRINT @ADR ; "HEAD OFF"          'Sets the header OFF.
130 PRINT @ADR ; "ACVSET  ?"         'Reads back the AC voltage set
                                      value.
140 INPUT @ADR ; RESP$
150 PRINT "The response message to ACVSET? for HEAD OFF is" ;RESP$;"."
160 PRINT @ADR ; "HEAD ON"           'Sets the header ON.
170 PRINT @ADR ; "ACVSET  ?"         'Reads back the AC voltage set
                                      value.
180 INPUT @ADR ; RESP$
190 PRINT "The response message to ACVSET? for HEAD ON is" ;RESP$;"."
200 END
```

Sample program (for RS11-PCR-L)

```
:
100 ADR = 1                                    'RS11-PCR-L address
110 OPEN "COM1 : N81NN" AS #1                  'Initializes PC-9801.
120 PRINT #ADR, "HEAD OFF"                     'Sets the header OFF.
130 PRINT #ADR, "ACVSET ?"                     'Reads back the AC
                                                voltage set value.
140 INPUT #ADR,RESP$
150 PRINT "The response message to ACVSET? for HEAD OFF is";
          RESP$;"."
160 PRINT #ADR,"HEAD ON"                       'Sets the header ON.
170 PRINT #ADR,"ACVSET ?"                      'Reads back the AC voltage
                                                set value.
180 INPUT #ADR,RESP$
190 PRINT "The response message to ACVSET ? for HEAD ON is";
          RESP$;"."
200 END
```

5.1.2 Setting Response Message Terminator ([TERM])

The GP-IB Interface/RS-232C Interface sends a termination symbol at the end of a response message to inform the GPIB controller or RS-232C terminal of completion of the response message. This termination symbol is called a "response message terminator" (or delimiter).

Sending and receiving data via GPIB or RS-232C communication requires that the response message terminator be set up beforehand. An incorrect response message terminator set-up can disable the sending and receiving of data. The GP-IB Interface/ RS-232C Interface permits selection of one of four response message terminators, as shown in the table below. (Note that EOI is available for GPIB communication only; RS-232C communication does not use EOI.)

[TERM] command	Response message terminator
[TERM 0]	CRLF + EOI
[TERM 1]	CR + EOI
[TERM 2]	LF + EOI
[TERM 3]	EOI

(Setting at factory shipment)

CR : Carriage Return
LF : Line Feed
EOI : End or Identify

- Use the [TERM?] command to determine the response message terminator set value.
- The relationship between the [TERM?] command response data and the response message terminator is the same as that between the [TERM] command and the response message terminator.

Sample program (for IB11-PCR-L)

```
:
100 ADR = 1                              'IB11-PCR-L address
110 ISET IFC:ISET REN : CMD DELIM=0  'Initializes PC-9801.
120 PRINT @ADR ; "HEAD OFF"          'Sets the header OFF.
130 PRINT @ADR ; "TERM  ?"           'Reads back the terminator.
140 INPUT @ADR ; RESP$
150 A=VAL(RESP$)
160 IF A=0 THEN PRINT "Response message terminator is CRLF + EOI."
170 IF A=1 THEN PRINT "Response message terminator is CR + EOI."
180 IF A=2 THEN PRINT "Response message terminator is LF + EOI."
190 IF A=3 THEN PRINT "Response message terminator is EOI."
200 END
```

Sample program (for RS11-PCR-L)

```
:
100 ADR = 1                                  'RS11-PCR-L address
110 OPEN "COM1 : N81NN"AS #1                 'Initializes PC-9801.
120 PRINT #ADR, "HEAD OFF"                   'Sets the header OFF.
130 PRINT #ADR, "TERM ?"                     'Reads back the terminator.
140 INPUT #ADR, RESP$
150 A=VAL(RESP$)
160 IF A=0 THEN PRINT "Response message terminator is CRLF."
170 IF A=1 THEN PRINT "Response message terminator is CR."
180 IF A=2 THEN PRINT "Response message terminator is LF."
200 END
```

5.1.3 Acquiring Model Information ([IDN?])

Use the [IDN?] command to determine the PCR-L AC Power Supply model number and ROM version. The relationship between the model number and response message is as shown below:

Model number	Response message
PCR500L	IDN PCR500L VERX.XX KIKUSUI
PCR1000L	IDN PCR1000L VERX.XX KIKUSUI
PCR2000L	IDN PCR2000L VERX.XX KIKUSUI
PCR4000L	IDN PCR4000L VERX.XX KIKUSUI
PCR6000L	IDN PCR6000L VERX.XX KIKUSUI

Sample program (for IB11-PCR-L)

```
:
100 ADR = 1                              'IB11-PCR-L address
110 ISET IFC : ISET REN:CMD DELIM=0  'Initializes PC-9801.
120 PRINT @ADR;"HEAD OFF"            'Sets the header OFF.
130 PRINT @ADR;"IDN ?"               'Reads back model information.
140 INPUT @ADR;RESP$
150 PRINT "Response data to the IDN? command is" ;RESP$;"."
160 END
```

Sample program (for RS11-PCR-L)

```
:
100 ADR=1                                'RS11-PCR-L address
110 OPEN "COM1 : N81NN" AS #1        'Initializes PC-9801.
120 PRINT #ADR,"HEAD OFF"            'Sets the header OFF.
130 PRINT #ADR, "IDN ?"              'Reads back model information.
140 INPUT #ADR,RESP$
150 PRINT "Response data to the IDN? command is" ;RESP$;"."
160 END
```

5.1.4 Acquiring Command Error Information ([ERR?])

If an error occurs in a command message, the status byte register ERR bit (bit 3) is set to "1". Use the [ERR?] command to check the cause of the error at this time.
The GP-IB Interface/RS-232C Interface sends the following error register content (a three-digit decimal number) as the response message to the [ERR?] command. The error register content is held until command error information is read using the [ERR?] command or until the error register is cleared using the [CLR] or [SETINI] command.

MSB LSB

7	6	5	4	3	2	1	0
SVE						ORE	SER

Bit 0 [SER] : Syntax error
Bit 1 [ORE] : Out of range error
Bit 2 [ ] : "0"
Bit 3 [ ] : "0"
Bit 4 [ ] : "0"
Bit 5 [ ] : "0"
Bit 6 [ ] : "0"
Bit 7 [SVE] : Set-up violation error

Example: In the event of syntax error
Bit 0 is set to "1." The error register value becomes a binary number of "00000001". This binary number is converted into a three-digit decimal number, and "001" is output as the response data.

Sample program (for IB11-PCR-L)

```
:
100 ADR = 1                              'IB11-PCR-L address
110 ISET IFC : ISET  REN:CMD DELIM=0 'Initializes PC-9801.
120 PRINT @ADR; "HEAD OFF"               'Sets the header OFF.
130 PRINT @ADR; "ERR ?"                  'Reads back an error number.
140 INPUT @ADR;RESP$
150 A=VAL(RESP$)
160 '***** Error Identification *****
170 IF A=0 THEN PRINT "No error has occurred."
180 IF A>=128 THEN PRINT "A set-up violation error.":A=A-128
190 IF A>=2 THEN PRINT "An out-of-range error has occurred.":A=A-2
200 IF A=1 THEN PRINT  "A syntax error has occurred."
210 END
```

Sample program (for RS11-PCR-L)

```
:
100 ADR = 1                              'RS11-PCR-L address
110 OPEN "COM1:N81NN" AS #1              'Initializes PC-9801.
120 PRINT #ADR,"HEAD OFF"                'Sets the header OFF.
130 PRINT #ADR,"ERR ?"                   'Reads back an error number.
140 INPUT #ADR,RESP$
150 A=VAL(RESP$)
160 '***** Error Identification *****
170 IF A=0 THEN PRINT "No error has occurred."
180 IF A>=128 THEN PRINT "A set-up violation error.": A=A-128
190 IF A>=2 THEN PRINT "An out-of-range error has occurred.": A=A-2
200 IF A=1 THEN PRINT "A syntax error has occurred."
210 END
```

5.1.5 Error Register Clear ([CLR])

The [CLR] command clears the bits of the error register to "0." The [CLR] command has no program data.

5.1.6 Set Value Clear ([SETINI])

The [SETINI] command is used to return set values to the factory shipment (default) status. However, this command does not clear the following set values; they will remain the same.

- Values stored in the memory
- Sequence operation parameters
- Alarm status (to clear this, use the [ALMCLR] command)
- User-defined waveform data

Sample program (for RS11-PCR-L)

```
:
100 ADR = 1                              'RS11-PCR-L address
110 OPEN "COM1:N81NN" AS #1              'Initializes PC-9801.
120 PRINT #ADR,"OUT OFF"                 'Output OFF
130 PRINT #ADR,"ACDC DC"                 'DC mode
140 PRINT #ADR,"RANGE 200V"              '200 V output voltage range
150 PRINT #ADR,"DCVSET 100V"             'DC voltage set value of 100 V
160 PRINT "Status before SETINI is executed"
170 PRINT #ADR,"ACDC  ?"                 'Reads back the AC/DC mode.
180 INPUT #ADR,RESP$
190 PRINT "AC/DC mode is" ;RESP$;"."
200 PRINT #ADR,"RANGE  ?"                'Reads back output voltage
                                          range.
210 INPUT #ADR,RESP$
220 PRINT "RANGE is" ;RESP$;"."
230 PRINT #ADR,"DCVSET  ?"               'Reads back a DC voltage set
                                          value.
240 INPUT #ADR,RESP$
250 PRINT "DC voltage set value is" ;RESP$;"."
260 PRINT #ADR,"SETINI"                  'Initializes IB11-PCR-L.
270 PRINT #ADR,"HEAD OFF"                'Sets the header OFF.
280 PRINT "Status obtained after SETINI is executed"
290 PRINT #ADR,"ACDC  ?"                 'Reads back the AC/DC mode.
300 INPUT #ADR,RESP$
310 PRINT "AC/DC mode is" ;RESP$;"."
320 PRINT #ADR,"RANGE  ?"                'Reads back output voltage
                                          range.
330 INPUT #ADR,RESP$
340 PRINT "RANGE is" ;RESP$;"."
350 PRINT #ADR,"DCVSET  ?"               'Reads back a DC voltage set
                                          value.
360 INPUT #ADR,RESP$
370 PRINT "DC voltage set value is" ;RESP$;"."
380 PRINT "Set values have been cleared."
390 END
```

5.1.7 Acquiring Alarm Information ([SELFTEST?])

Use the [SELFTEST?] command to determine the cause and location of an alarm that has occurred in the PCR-L AC Power Supply. The table below shows response data to the [SELFTEST?] command and their meaning. In the event of an alarm, commands other than [ALMCLR] and [SELFTEST] may not operate normally.

Response data to the [SELFTEST?] command	Meaning
SELFTEST OK	No alarm occurrence
SELFTEST ADRxx,NOx	Occurrence of alarm indicated by NOx at a location indicated by ADRxx

- If an alarm occurs at multiple locations, or if multiple alarms occur at a single location, use the [SELFTEST?] command for each. This allows individual alarm information to be acquired in turn. When information about the final alarm has been acquired, repeating the [SELFTEST?] command simply returns the final alarm information.

(For the location of alarm occurrences, alarm number, and countermeasures against error occurrence, see Section 9.2, Measures to be Taken in the Event of an Alarm, in the PCR-L AC Power Supply Operation Manual.

Sample program (for IB11-PCR-L)

```
:
100 ADR = 1                              'IB11-PCR-L address
110 ISET IFC:ISET REN:CMD DELIM=0        'Initializes PC-9801.
120 PRINT @ADR;"HEAD ON"                 'Sets the header ON.
130 PRINT "Self-test result "
140 PRINT @ADR;"SELFTEST  ?"             'Reads back the self-test
                                          result.
150 LINE INPUT @ADR;RESP1$               'Inputs a single line of the
                                          self-test result.
160 PRINT RESP1$                         'Displays a single line of the
                                          self test result.
170 IF RESP1$="" THEN END                'End of self-test data
180 IF RESP1$<>"SELFTEST OK" THEN GOTO 140
190 END
```

Sample program (for RS11-PCR-L)

```
:
100 ADR = 1                                    'RS11-PCR-L address
110 OPEN "COM1:N81NN" AS #1                    'Initializes PC-9801.
120 PRINT #ADR,"HEAD ON"                       'Sets the header OFF.
130 PRINT "Self-test result"
140 PRINT #ADR,"SELFTEST ?"                    'Reads back the self-test result.
150 LINE INPUT #ADR,RESP1$                     'Inputs a single line of the self-test
result.
160 PRINT RESP1$                               'Displays a single line of the self test
result.
170 IF RESP1$="" THEN END                      'End of self-test data
180 IF RESP1$<>"SELFTEST OK" THEN GOTO 140
190 END
```

5.1.8 Alarm Clear ([ALMCLR])

Use the [ALMCLR] command to clear an alarm. The [ALMCLR] command has no program data. (For details, see the PCR-L AC Power Supply Operation Manual.)

In the event of an alarm, commands other than [ALMCLR] and [SELFTEST] may not operate normally.

5.1.9 IB01-PCR Command Support ([IB01PCR])

The [IB01PCR] command allows the commands of the IB01-PCR (conventional PCR series GP-IB option) to be used on the GP-IB Interface/RS-232C Interface. The [IB01PCR] command has no program data.
Execution of the [IB01PCR] command enables the following operations:

- All commands available on the IB01-PCR can also be used on the GP-IB Interface/ RS-232C Interface.
- The configuration of the various registers becomes the same as that of the IB01-PCR.
- The commands available on the GP-IB Interface/RS-232C Interface but not provided for the IB01-PCR are disabled.
- The [IB01PCR] command cannot be canceled unless the POWER switch is turned OFF.

(For information about the IB01-PCR, see the IB01-PCR Operation Manual.)

[Description] Use of the [IB01PCR] command allows running of various programs generated for the IB01-PCR. However, differences in the specifications and operating characteristics between the PCR-L AC Power Supplies and the conventional PCR AC Power Supplies, may cause a deviation

in timing between a command and its operation. Even if the same program is executed, therefore, its operation may differ between the IB01-PCR and the GP-IB Interface/RS-232C Interface.

[Description] When using a program for the IB01-PCR on the GP-IB Interface/RS-232C Interface, it is recommended that the program be modified for the interface rather than being used "as is" with the [IB01PCR] command.

5.1.10 RS-232C Acknowledgement Message ON/OFF ([SILENT])

The [SILENT] command allows the RS-232C acknowledgement message to be set ON/OFF.

[SILENT] command	Acknowledgement message status	
[SILENT 1] [SILENT ON]	Not assigned	(Setting at POWER ON)
[SILENT 0] [SILENT OFF]	Assigned	

5.1.11 Update Operation Setting ([BACKUP])

The [BACKUP] command allows EEPROM update operations for voltage, frequency, and other setting values to be set ON/OFF.

[BACKUP] command	EEPROM update operation status	
[BACKUP 1] [BACKUP ON]	Updated	(Setting at POWER ON)
[BACKUP 0] [BACKUP OFF]	Not updated	

- Setting values are backed up by the EEPROM in the PCR-L AC Power Supply. However, there is a limitation on the number of EEPROM update operations. (See Section 10.3, [Description], in the PCR-L AC Power Supply Operation Manual.) If voltage or frequency setting has been changed frequently using this interface board, we recommend you to set update operation off to save the life of the EEPROM.
- If the update operation is set to off and the GPIB address and RS-232C parameters are changed, the changed values are not backed up also. To remain the values, change them after turning ON the PCR-L AC Power Supply POWER switch again or setting on the update operation.
- This command is available to the PCR-L AC Power Supply ROM Ver.2.04 or higher.

5.2 Register Commands

Internal registers

The GP-IB Interface/RS-232C Interface has six internal registers that can be externally accessed. Each register consists of eight bits, and three-digit decimal data (000 to 255) is returned when a register is read. These internal registers are as follows:

Status byte register	:	Indicates the GP-IB Interface/RS-232C Interface status.
Unmask register	:	Selects the cause of generation of SRQ (Service ReQuest).
Fault register	:	Indicates the fault status that changes with a cause (other than operation or control of the GP-IB Interface/RS-232C Interface). This register also causes the status byte register content to change.
Fault unmask register	:	Selects whether the fault register content is changed.
Status register	:	Indicates the status that changes with a cause (other than operation or control of the GP-IB Interface/RS-232C Interface).
Mode register	:	Indicates the operating status of the GP-IB Interface/RS-232C Interface.

- The serial poll and service request functions are provided for GPIB communications only; these cannot be used for RS-232C communications. For RS-232C communication, use the [STB?] command instead.

5.2.1 Acquiring the Status Byte Register Content ([STB?])

The status byte register indicates the operating status of the GP-IB Interface/RS-232C Interface. When a certain status is in effect, the relevant bit is set to "1." Use the serial polling or [STB?] command to read the status byte register content. The status byte register holds its values until the relevant value is read. Permission for generating a service request can be specified using the unmask register (see 5.2.2).
The status byte register configuration is as shown below.

MSB LSB

7	6	5	4	3	2	1	0
3PE	RQS			ERR	SE	PON	FAU

Bit 0 [FAU] : Indicates that one or more fault register bits is "1".
Bit 1 [PON] : Indicates that POWER has been turned ON.
Bit 2 [SE] : Indicates that a sequence operation has ended.
Bit 3 [ERR] : Indicates that a syntax error has occurred.
Bit 4 [ ] : "0"
Bit 5 [ ] : "0"
Bit 6 [RQS] : Indicates that a service request was generated.
Bit 7 [ ] : "0"

5.2.2 Unmask Register Setting ([UNMASK])

The unmask register is used to specify whether generation of a service request is permitted when the relevant status byte register bit is set to "1." If a bit is "1," generation of a service request is permitted; if "0," generation of a service request is prohibited.

The unmask register can be set using the [UNMASK] command, and its values can be read using the [UNMASK?] command. The unmask register bit configuration is as follows:

MSB LSB

7	6	5	4	3	2	1	0
				ERR	SE		FAU

Bit 0 [FAU] : Permits generation of a service request if any of the fault register bits is "1".
Bit 1 [ ] : "0"
Bit 2 [SE] : Permits generation of a service request when a sequence operation ends.
Bit 3 [ERR] : Permits generation of a service request in the event of a command error.
Bit 4 [ ] : "0"
Bit 5 [ ] : "0"
Bit 6 [ ] : "0"
Bit 7 [ ] : "0"

5.2.3 Acquiring the Fault Register Content ([FAU?])

If any of the fault register bits is set to "1," the status byte register FAU bit (bit 0) changes. Whether each fault register bit is changed can be specified using the fault unmask register (see 5.2.4).
Use the [FAU?] command to read the fault register content. The fault register has a holding function, so the status of bits that are set to "1" is maintained until the relevant bit is read. The fault register bit configuration is as shown below.

MSB LSB

7	6	5	4	3	2	1	0
ALM	OLP	ASO	HER	INT	DAV		

Bit 0 [ ] : "0"
Bit 1 [ ] : "0"
Bit 2 [DAV] : Indicates that the measured value has been updated.
Bit 3 [INT] : Indicates that power line abnormality simulation has ended.
Bit 4 [HER] : Indicates that a PCR-L AC Power Supply hardware error has occurred.
Bit 5 [ASO] : Indicates that the internal semiconductor protection circuit has been activated.
Bit 6 [OLP] : Indicates that the current limit has operated.
Bit 7 [ALM] : Indicates that another alarm has occurred.

5.2.4 Setting the Fault Unmask Register ([FUNMASK])

The fault unmask register is used to permit whether the fault register content is changed on a bit basis. If a fault unmask regiser bit is "1," the fault unmask register allows the relevant fault register bit to change.
The fault unmask register can be set using the [FUNMASK] command, and its values can be read using the [FUNMASK?] command. The fault unmask register bit configuration is as shown below:

MSB LSB

7	6	5	4	3	2	1	0
ALM	OLP	ASO	HER	INT	DAV		

Bit 0 [ ] : "0"
Bit 1 [ ] : "0"
Bit 2 [DAV] : Permits whether the bit changes when a measured value is updated.
Bit 3 [INT] : Permits whether the bit changes when a power line abnormality simulation ends.
Bit 4 [HER] : Permits whether the bit changes when PCR-L AC Power Supply hardware error occurs.
Bit 5 [ASO] : Permits whether the bit changes when an internal semiconductor protection circuit is activated.
Bit 6 [OLP] : Permits whether the bit changes when a current limit operates.
Bit 7 [ALM] : Permits whether the bit changes when another alarms occur.

5.2.5 Acquiring the Status Register Content ([STS?])

The status register indicates the status that changes from a cause other than operation or control of the GP-IB Interface/RS-232C Interface. Use the [STS?] command to read the status register content. The status register bit configuration is as shown below.

MSB LSB

7	6	5	4	3	2	1	0
ALM	OLP	ASO	HER	INT	DAV		

Bit 0 [ ] : "0"
Bit 1 [ ] : "0"
Bit 2 [DAV] : Indicates that the measured value has been updated.
Bit 3 [INT] : Indicates that power line abnormality simulation has ended.
Bit 4 [HER] : Indicates that a PCR-L AC Power Supply hardware error has occurred.
Bit 5 [ASO] : Indicates that the internal semiconductor protection circuit has been activated.
Bit 6 [OLP] : Indicates that the current limit has operated.
Bit 7 [ALM] : Indicates that another alarm has occurred.

Sample program (for IB11-PCR-L)

```
:
100 ADR = 1                              'IB11-PCR-L address
110 ISET IFC:ISET  REN:CMD DELIM=0  'Initializes PC-9801.
120 PRINT @ADR;"HEAD OFF"           'Sets the header to OFF.
130 I=0
140 PRINT @ADR;"VMRMS"              'rms voltage measurement
150 PRINT @ADR;"VOUT  ?"            'Reads back output voltage.
160 INPUT @ADR;RESP$
170 PRINT RESP$
180 IF I>=10 THEN END ELSE I=I+1
190 PRINT @ADR;"STS?"               'Reads back the status register.
200 INPUT @ADR; RESP$
210 STS=VAL(RESP$)
220 IF STS=4 THEN GOTO 150 ELSE GOTO 190  'Measurement completion check
```

Sample program (for RS11-PCR-L)

```
:
100 ADR = 1                              'RS11-PCR-L address
110 OPEN "COM1:N81NN" AS #1         'Initializes PC-9801.
120 PRINT #ADR;"HEAD OFF"           'Sets the header to OFF.
130 I=0
140 PRINT #ADR;"VMRMS"              'rms voltage measurement
150 PRINT #ADR;"VOUT  ?"            'Reads back output voltage.
160 INPUT #ADR;RESP$
170 PRINT RESP$
180 IF I>=10 THEN END ELSE I=I+1
190 PRINT #ADR;"STS?"               'Reads back the status register.
200 INPUT #ADR,RESP$
210 STS=VAL(RESP$)
220 IF STS=4 THEN GOTO 150 ELSE GOTO 190  'Measurement completion check
```

5.2.6 Acquiring the Mode Register Content ([MOD?])

The mode register indicates the operating status of the GP-IB Interface/RS-232C Interface. Use the [MOD?] command to read the mode register content. The mode register bit configuration is as shown below.

MSB LSB

7	6	5	4	3	2	1	0
	FHA	WAV	OUZ		RNG	ADC	DC

Bit 0 [DC] : DC mode ("1")/AC mode ("0")
Bit 1 [ADC] : AC + DC mode
Bit 2 [RNG] : Output voltage range: 200 V range ("1")/100 V range ("0")
Bit 3 [ ] : "0"
Bit 4 [OUZ] : Indicates that output impedance has been set.
Bit 5 [WAV] : Indicates that the waveform was switched.
Bit 6 [FHA] : Indicates that output ON/OFF phase has been set.
Bit 7 [ ] : "0"

5.3 Peripheral Function Setting Commands

5.3.1 Output ON/OFF ([OUT])

Output ON/OFF can be controlled by the [OUT] command.

OUT command	Output status
[OUT 0] [OUT OFF]	OFF
[OUT 1] [OUT ON]	ON

(Setting at POWER ON)

- Use the [OUT?] command to read the output ON/OFF status. Response data to this command is [001] (for ON) or [000] (for OFF).

5.3.2 Output Voltage Range Setting ([RANGE])

The output voltage range can be set using the [RANGE] command. Switching of the output voltage range is accomplished only when output is OFF.

[RANGE] command	Output voltage range status
[RANGE 0] [RANGE 100]	100 V range
[RANGE 1] [RANGE 200]	200 V range

(Setting at factory shipment)

- Use the [RANGE?] command to read the output voltage range. Response data to this command is [001] (for 200 V range) or [000] (for 100 V range).

5.3.3 AC, DC, or AC + DC Mode Selection ([ACDC])

AC, DC, or AC + DC mode can be set using the [ACDC] command. The [ACDC] command is accepted only when output is OFF.

[ACDC] command	Output mode status
[ACDC 0] [ACDC AC]	AC mode
[ACDC 1] [ACDC DC]	DC mode
[ACDC 2] [ACDC ADC]	AC + DC mode

(Setting at factory shipment)

- Use the [ACDC?] command to read the output mode data; AC, DC, or AC + DC. Response data to this command is as follows:

  [000] : AC mode
  [001] : DC mode
  [002] : AC + DC mode

- The AC or DC mode is stored inside the PCR-L AC Power Supply even when the POWER switch is turned OFF. Therefore, the same mode is selected when the POWER switch is turned ON again. The AC + DC mode status can be stored in case that the RC02-PCR-L Remote Controller is connected. Otherwise, this mode is not stored (and the AC mode is selected instead).

5.3.4 Synchronous Operation ([SYNC])

Synchronous operation can be set using the [SYNC] command. Synchronous operation is available only in the AC mode.

[SYNC] command	Synchronous status
[SYNC 0] [SYNC OFF]	OFF
[SYNC 1] [SYNC ON]	ON

(Setting at POWER ON)

- Use the [SYNC?] command to read synchronous operation status. Response data to this command is [000] (for non-synchronous status) or [001] (for synchronous status)

5.3.5 Output Impedance Setting ([OUTZ])

The GP-IB Interface/RS-232C Interface allows setting of output impedance (output resistance) only in the AC mode. The maximum output impedance value that is settable differs depending on the PCR-L AC Power Supply model and output voltage range. Resolution is 1/100 of the maximum resistance value settable, and resolution steps that can be set are integral multiples of the resolution. The table below shows the model-based maximum output impedance.

Model No.	100 V range	200 V range
PCR500L	4.00000Ω	16.00000Ω
PCR1000L	2.00000Ω	8.00000Ω
PCR2000L	1.00000Ω	4.00000Ω
PCR4000L	0.50000Ω	2.00000Ω
PCR6000L	0.33333Ω	1.33333Ω

- Output impedance can be set using the [OUTZ] command. Program data is set as a real number (Ω unit).
- As long as program data falls within settable steps, an output impedance set value is converted to the maximum value that is less than the program data set value.

Example: If the model used is a PCR1000L, and the output voltage range is the 100 V range, the maximum settable resistance value is 2 Ω, and its resolution is 0.02 Ω. If command [OUTZ 1.01] is sent under this condition, the resistance value actually set is 1 Ω (the maximum value not exceeding 1.01) because the set value falls within the resolution steps.

- If the output voltage range is switched when output impedance has been set, the output impedance set value is cleared to 0 Ω.
- Use the [OUTZ?] command to read the output impedance set value. Response data to this command is the value obtained by converting the data sent using the [OUTZ] command based on the actually set resistance value into a settable step. The response data is a real number of up to five decimal places (Ω unit).
- Output impedance data is stored inside the PCR-L AC Power Supply even when the POWER switch is turned OFF. Therefore, the last value is selected when the POWER switch is turned ON again. When output impedance has been set, the control panel S-MODE display area displays "2."

Example: [OUTZ?]: Response message to the OUTZ? command
[OUTZ 1.00000 OHM]: Output impedance has been set to 1 Ω.
[OUTZ 0.00000 OHM]: No output impedance has been set.

Sample program (for IB11-PCR-L)

```
:
100 ADR = 1                                 'IB11-PCR-L address
110 ISET IFC:ISET REN:CMD DELIM=0            'Initializes PC-9801.
120 PRINT @ADR;"HEAD OFF"                   'Sets the header to OFF.
130 PRINT @ADR;"ACDC  ?"                    'Reads back the AC/DC mode.
140 INPUT @ADR;RESP$
150 A=VAL(RESP$)
160 IF A<>0 THEN GOTO *ACDCERR              'An error occurs in any mode
                                             other than AC mode.
170 PRINT @ADR;"IDN  ?"                     'Reads back model information.
180 INPUT @ADR;RESP$
190 B$=MID$(RESP$,4,1)
200 A=VAL(B$)
210 IF A=5 THEN KVA=.5 ELSE KVA=A           'Determines the relevant
                                             model's power capacity.
220 PRINT @ADR;"RANGE  ?"                   'Reads back output voltage
                                             range.
230 INPUT @ADR;RESP$
240 RANGE=VAL(RESP$)
250 ZMAX=(RANGE*3+1)*2/KVA                  'Calculates output impedance
                                             maximum value.
260 INPUT "Enter the desired resistance value. ";OUTZ
270 IF OUTZ>ZMAX THEN *MAXERR               'Output impedance range check
280 PRINT @ADR;"OUTZ "+STR$(OUTZ)           'Sets output impedance.
290 PRINT @ADR;"OUTZ  ?"                    'Reads back output impedance.
300 INPUT @ADR;RESP$
310 A=VAL(RESP$)
320 PRINT "Output impedance has been set to ";A;" Ω."
330 END
340 *ACDCERR                                'Error display
350 PRINT "The OUTZ command is valid only in the AC mode."
360 PRINT "Select the AC mode, then use the OUTZ command."
370 END
380 *MAXERR                                 'Error display
390 PRINT "Output impedance setting range has been exceeded."
400 END
```

5.3.6 Output ON/OFF Phase Setting ([ONPHASE], [OFFPHASE])

The GP-IB Interface/RS-232C Interface allows output ON/OFF phase to be individually set only in the AC mode. If no phase is set (FREE is selected), output ON/OFF is accomplished in random phase. This status is called "a state in which output ON/OFF phase setting has been canceled."

Settable phase is in the range of 0 to 360 degrees in 1 degree steps, with one AC cycle regarded as 360 degrees. To set output ON phase, use the [ONPHASE] command; to set output OFF phase, use the [OFFPHASE] command.

Use an integer value (0 to 360) to set program data, or specify [FREE] to cancel the setting.

Output ON and OFF phases can be read by using the [ONPHASE?] and [OFFPHASE?] commands, respectively. The response message to each command is the same as the data set by the ONPHASE/OFFPHASE command. Output ON/OFF phase data is stored inside the PCR-L AC Power Supply even when the POWER switch is turned OFF. Therefore, the last setting is selected when the POWER switch is turned ON again. When output ON/OFF phases have been set, the control panel S-MODE display area displays "5."

Examples: To set output ON phase to 90 degrees
Program message: [ONPHASE 90]

To cancel output OFF phase
Program message: [OFFPHASE FREE]

To read out the output ON phase set value
Program message: [ONPHASE?]
Response message: [ONPHASE 90DEG]

Sample program (for RS11-PCR-L)

```
:
100 ADR = 1                                  'RS11-PCR-L address
110 OPEN "COM1:N81NN" AS #1                  'Initializes PC-9801.
120 PRINT #ADR,"HEAD OFF"                    'Sets the header to OFF.
130 PRINT #ADR,"ACDC  ?"                     'Reads back the AC/DC mode.
140 INPUT #ADR,RESP$
150 A=VAL (RESP$)
160 IF A<>0 THEN GOTO *ACDCERR               'An error occurs in any mode
                                              other than AC mode.
170 PRINT "Enter the desired output ON phase."
180 INPUT "Setting the phase in excess of 361 degrees causes the
          phase setting to be FREE. ";PHASE
190 IF PHASE>361 THEN PHA$="FREE" ELSE PHA$=STR$ (PHASE)
200 PRINT #ADR;"ONPHASE "+PHA$               'Sets output ON phase.
210 PRINT #ADR;"ONPHASE  ?"                  'Reads back output ON phase.
220 INPUT #ADR;RESP$
230 PRINT "Output ON phase has been set to" ;RESP$;"."
240 END
250 *ACDCERR                                 'Error display
260 PRINT "The ONPHASE command is valid only in the AC mode."
270 PRINT "Select the AC mode, then use the ONPHASE command."
280 END
```

```
:
100 ADR = 1                                  'RS11-PCR-L address
110 OPEN "COM1:N81NN" AS #1                  'Initializes PC-9801.
120 PRINT #ADR,"HEAD OFF"                    'Sets the header to OFF.
130 PRINT #ADR,"ACDC  ?"                     'Reads back the AC/DC mode.
140 INPUT #ADR,RESP$
150 A=VAL (RESP$)
160 IF A<>0 THEN GOTO *ACDCERR               'An error occurs in any mode
                                              other than AC mode.
170 PRINT "Enter the desired output OFF phase."
180 INPUT "Setting the phase in excess of 361 degrees causes the
          phase setting to be FREE."; PHASE
190 IF PHASE>361 THEN PHA$="FREE" ELSE PHA$=STR$ (PHASE)
200 PRINT #ADR,"OFFPHASE "+PHA$              'Sets output OFF phase.
210 PRINT #ADR,"OFFPHASE  ?                  'Reads back output OFF phase.
220 INPUT #ADR,RESP$
230 PRINT "Output OFF phase has been set to" ;RESP$;"."
240 END
250 *ACDCERR                                 'Error display
260 PRINT "The OFFPHASE command is valid only in the AC mode."
270 PRINT "Select the AC mode, then use the OFFPHASE command."
280 END
```

5.4 Output Voltage and Frequency Setting Commands

The GP-IB Interface/RS-232C Interface has AC, DC, and AC + DC output modes. Output voltage setting is accomplished for AC and DC voltages individually.

5.4.1 AC Voltage Setting ([VSET], [ACVSET])

AC voltage can be set using the [VSET] or [ACVSET] command. These two commands function the same.
The program data effective range is determined based on the output voltage range and AC output voltage limits. Data meeting all of the following conditions 1 to 3 forms the effective range.
If the GP-IB Interface/RS-232C Interface receives data outside of the effective range, such data is ignored and the status byte register ERR bit (bit 3) is set to "1." The cause of the error can be checked using the [ERR?] command.

Condition 1 : [AC output voltage low limit] ≦ [Set voltage] ≦ [AC output voltage high limit] and 0 V (0 V: Always settable)
Condition 2 : For 100 V output range in the AC mode, 0 ≦ [Set voltage] ≦ 152.5 V
For 200 V output range in the AC mode, 0 ≦ [Set voltage] ≦ 305.0 V
Condition 3 : For 100 V output range in the AC + DC mode, [Set voltage] × 1.41 + [Set DC voltage absolute value] ≦215.5 V
For 200 V output range in the AC + DC mode, [Set voltage] × 1.41 + [Set DC voltage absolute value] ≦ 431.0 V

Use the [VSET?] or [ACVSET?] command to read the AC voltage set value.

Examples: To set AC voltage to 100 V: [VSET 100]
To determine AC voltage set value: [ACVSET?]
The relevant response message: [ACVSET 100.0V]

Sample program (for RS11-PCR-L)

```
:
100 ADR = 1                              'RS11-PCR-L address
110 OPEN "COM1:N81NN" AS #1              'Initializes PC-9801.
120 PRINT #ADR,"HEAD OFF"                'Sets the header to OFF.
130 PRINT #ADR,"ACDC  ?"                 'Reads back the AC/DC mode.
140 INPUT #ADR,RESP$
150 ACDC=VAL (RESP$)
160 PRINT #ADR,"ACVSET  ?"               'Reads back AC voltage set
                                          value.
170 INPUT #ADR,RESP$
180 ACV=VAL (RESP$)
190 PRINT #ADR,"DCVSET  ?"               'Reads back DC voltage set
                                          value.
200 INPUT #ADR,RESP$
```

```
210 DCV=VAL (RESP$)
220 PRINT #ADR,"FSET  ?"              'Reads back frequency set
                                       value.
230 INPUT #ADR,RESP$
240 F=VAL (RESP$)
250 PRINT #ADR,"OUT  ?"               'Reads back output ON/OFF
                                       status.
260 INPUT #ADR,RESP$
270 A=VAL (RESP$)
280 CLS                               'Set value display
290 IF A=0 THEN OUTPUT$="OFF" ELSE OUTPUT$="ON"
300 IF ACDC<>1 THEN PRINT " [A] ACVSET = ";ACV
310 IF ACDC>1 THEN PRINT " [D] DCVSET = ";DCV
320 IF ACDC<>1 THEN PRINT " [F] FSET = ";F
330 PRINT " [O] OUTPUT = ";OUTPUT$
340 PRINT " [E] END"
350 PRINT
360 PRINT "Press one of those in [ ]."
370 I$=INPUT$(1)
380 IF ACDC=2 THEN K=INSTR("AaDdFfOoEe",I$) ELSE 420
390 IF K=0 THEN 370
400 ON K GOSUB *AC, *AC, *DC, *DC, *FSET, *FSET, *OUTPUT,
    *OUTPUT, *EXIT, *EXIT
410 GOTO 160
420 IF ACDC=0 THEN K=INSTR("AaFfOoEe",I$) ELSE 460
430 IF K=0 THEN 370
440 ON K GOSUB *AC,*AC, *FSET, *FSET, *OUTPUT, *OUTPUT, *EXIT,
    *EXIT
450 GOTO 160
460 IF ACDC=1 THEN K=INSTR("DdOoEe",I$)
470 IF K=0 THEN 370
480 ON K GOSUB *DC, *DC, *OUTPUT, *OUTPUT, *EXIT, *EXIT
490 GOTO 160
500 *AC
510 INPUT "Enter the desired AC voltage."; D$
520 PRINT #ADR, "ACVSET "+D$          'AC voltage setting
530 RETURN
540 *DC
550 INPUT "Enter the desired DC voltage." ;D$
560 PRINT #ADR, "DCVSET "+D$          'DC voltage setting
570 RETURN
580 *FSET
590 INPUT "Enter the desired frequency."; D$
600 PRINT #ADR, "FSET "+D$
610 RETURN
620 *OUTPUT                           'Output ON/OFF setting
630 IF OUTPUT$="ON" THEN PRINT #ADR, "OUT OFF"
640 IF OUTPUT$="OFF" THEN PRINT #ADR, "OUT ON"
650 RETURN
660 *EXIT                             'Exit
670 END
```

5.4.2 DC Voltage Setting ([DCVSET])

DC voltage can be set using the [DCVSET] command. The program data effective range is determined based on the output voltage range and DC output voltage limits. Data meeting all of the following conditions 1 to 3 forms the effective range. If the GP-IB Interface/RS-232C Interface receives data outside of the effective range, such data is ignored and the status byte register ERR bit (bit 3) is set to "1." The cause of the error can be checked using the [ERR?] command.

Condition 1 : [DC output voltage low limit] ≦ [Set voltage] ≦ [DC output voltage high limit] and 0 V (0 V: Always settable)
Condition 2 : For 100 V output range in the DC mode, -215.5 V ≦[Set voltage] ≦ 215.5 V
For 200 V output range in the DC mode, -431.0 V ≦[Set voltage] ≦ 431.0 V
Condition 3 : For 100 V output range in the AC + DC mode, [AC voltage set value] × 1.41 + [Set voltage absolute value] ≦ 215.5 V
For 200 V output range in the AC + DC mode, [AC voltage set value] × 1.41 + [Set voltage absolute value] ≦ 431.0 V

Use the [DCVSET?] command to read the DC voltage set value.

Examples: To set DC voltage to 100 V: [DCVSET 100]
To determine DC voltage set value: [DCVSET?]
The relevant response message: [DCVSET 100.0V]

5.4.3 Frequency Setting ([FSET])

Frequency can be set using the [FSET] command. The program data effective range is determined based on the frequency limits. Data meeting both of the following conditions 1 and 2 forms the effective range. If the GP-IB Interface/RS-232C Interface receives data outside of the effective range, such data is ignored and the status byte register ERR bit (bit 3) is set to "1." The cause of the error can be checked using the [ERR?] command.

Condition 1 : [Frequency low limit] ≦ [Set frequency] ≦ [Frequency high limit]
Condition 2 : 1.00 Hz ≦ [Set frequency] ≦999.9 Hz

Use the [FSET?] command to read the frequency set value.

Examples: To set frequency to 400 Hz: [FSET 400]
To determine frequency set value: [FSET?]
The relevant response message: [FSET 400]

5.5 Output Measurement Commands

The output measurement commands are used for measurement at the PCR-L AC Power Supply output terminals or for specifying a method for setting the measurement mode.

5.5.1 Output Voltage Measurement ([VOUT?], [VMRMS], [VMAVE], [VMPK], [VMSET] and [VM?])

The GP-IB Interfacc/RS-232C Interface has three output voltage measurement methods:

- rms value measurement
- Peak value measurement
- Average value measurement
  (For information about each measurement method, see the PCR-L AC Power Supply Operation Manual.)

Output voltage measurement command	Output voltage measurement mode status
[VMRMS]	rms value measurement
[VMPK]	Peak value measurement
[VMAVE]	Average value measurement

(Setting at factory shipment)

(Valid in any mode other than AC mode)

Use the [VM?] command to read the output voltage measurement mode. The response message to this command is as follows:

- For rms value: [VMRMS]
- For peak value: [VMPK]
- For average value: [VMAVE]

Use the [VOUT?] command to read the measured voltage. On receiving the [VOUT?] command, the GP-IB Interface/RS-232C Interface returns as response data the measured-value obtained immediately before. The GP-IB Interface/RS-232C Interface voltage measurement cycle varies with output frequency (approximately 0.5 to 2 sec). During this measurement cycle, the same data is returned regardless of the number of [VOUT?] commands received.

The [VMSET] command is used to make the response message to the [VOUT?] command identical to the response message to the [VSET?] command.

Examples: To select the rms value measurement mode: [VMRMS]

To acquire measured-value mode data: [VM?]
The relevant response message: [VMRMS]

To read output voltage: [VOUT?]
The relevant response message: [VOUT 100.0] (for 100 V output voltage)

The [VMRMS], [VMAVE], [VMPK], and [VMSET] commands have no program data.

[Description] Use of status register DAV bit (bit 2)
The status register DAV bit indicates updating of the measured value. This bit is set to "0" if a measured-value read command (such as [VOUT?] or [IOUT?]) is executed, also this bit is set to "1" if the measured value is updated inside the GP-IB Interface/RS-232C Interface.
The GP-IB Interface/RS-232C Interface takes approximately 0.5 second to 2 seconds to update the measured value. Monitoring of the status register DAV bit allows program generation without waiting for the measured value to be updated using a timer.

Sample program (for IB11-PCR-L)

```
:
100 ADR = 1                              'IB11-PCR-L address
110 ISET IFC;ISET REN:CMD DELIM=0        'Initializes PC-9801.
120 PRINT @ADR;"HEAD OFF"                'Sets the header to OFF.
130 PRINT @ADR;"ACDC  ?"                 'Reads back the AC/DC mode.
140 INPUT @ADR;RESP$
150 ACDC=VAL (RESP$)
160 PRINT @ADR;"VMRMS"                   'rms voltage measurement
170 PRINT @ADR;"VOUT  ?"
180 INPUT @ ADR;RESP$
190 VRMS=VAL (RESP$)
200 PRINT @ADR;"VMPK"                    'Peak voltage measurement
210 PRINT @ADR;"VOUT  ?"
220 INPUT @ ADR;RESP$
230 VPK=VAL (RESP$)
240 PRINT @ADR;"ACVSET  ?"               'Reads back AC voltage set
                                          value.
250 INPUT @ADR;RESP$
260 ACVSET=VAL(RESP$)
270 PRINT @ADR;"DCVSET  ?"               'Reads back DC voltage set
                                          value.
280 INPUT @ADR;RESP$
290 DCVSET=VAL(RESP$)
300 IF ACDC=0 THEN GOTO 350              'Average value measurement
                                          applies in any mode other
                                          than AC mode.
310 PRINT @ADR;"VMAVE"
320 PRINT @ADR;"VOUT  ?"
330 INPUT @ADR;RESP$
340 VAVE=VAL(RESP$)
350 PRINT @ADR;"VMRMS"
360 CLS                                  'Measured value display
370 IF ACDC=0 THEN AD$="AC"
380 IF ACDC=1 THEN AD$="DC"
390 IF ACDC=2 THEN AD$="AC+DC"
400 PRINT " AC/DC mode is" ;AD$;"."
410 IF ACDC=1 THEN 430
420 PRINT " ACVset = ";ACVset
430 IF ACDC=0 THEN 450
440 PRINT " DCVset = ";DCVSET
450 PRINT
460 PRINT " Vrms = ";VRMS
470 IF ACDC=0 THEN 490
480 PRINT " Vave = ";VAVE
490 PRINT " Vpeak = ";VPK
500 END
```

5.5.2 Output Current Measurement ([IOUT?], [IMRMS], [IMAVE], [IMPK], [IMPKH], [IM?] and [PEAKINIT])

The GP-IB Interface/RS-232C Interface has four output current measurement methods:

- rms value measurement
- Peak value measurement
- Peak holding value measurement
- Average value measurement

To measure current, set the desired measurement method in advance. (For any measurement method other than peak holding current measurement, see the PCR-L AC Power Supply Operation Manual.) The table below shows the relationship between the output current measurement commands and output current measurement modes.

Output current measurement command	Output current measurement mode	
[IMRMS]	rms value measurement	(Setting at factory shipment)
[IMPK]	Peak value measurement	
[IMPKH]	Peak holding value measurement	(Valid in any mode other than AC mode)
[IMAVE]	Average value measurement	

Peak Holding Current Measurement

The peak holding current measurement of the GP-IB Interface /RS-232C Interface measures a peak current using the analog peak holding circuit, then determines the maximum absolute value of the data obtained. Therefore, the peak current is displayed as an absolute value (without polarity sign). The peak holding value is cleared using an external peak clear signal. A peak clear signal can be obtained by one of the following means.

- Signal from the PEAK INIT terminal at the upper rear part of the PCR-L AC Power Supply
- [PEAKINIT] command from the GP-IB Interface/RS-232C Interface
- Peak clear operation on the Remote Controller
  The peak holding value can be measured in the AC, DC, or AC + DC modes. The peak holding value measurement mode can be set using the [IMPKH] command.

[Description] Normal peak holding operation cannot be accomplished for up to two measurement cycles after the [PEAKINIT] command has been received. Take this into account when creating a program.
The [IMRMS], [IMAVE], [IMPK], [IMPKH], and [PEAKINIT] commands have no program data.

Use the [IM?] command to read the output current measurement mode. The response message to this command is as follows:

- For rms value measurement: [IMRMS]
- For peak value measurement: [IMPK]
- For peak holding value measurement: [IMPKH]
- For average value measurement: [IMAVE]

Use the [IOUT?] command to read the current measured-value. On receiving the [IOUT?] command, the GP-IB Interface /RS232C Interface returns as response data the measured-value obtained immediately before.

The GP-IB Interface/RS-232C Interface voltage measurement cycle varies with output frequency (approximately 0.5 second to 2 seconds). During this measurement cycle, the same data is returned even if the [IOUT?] command is received repeatedly. Use of the status register DAV bit (bit 2) allows you to perform effective programming.

Examples: To select the rms value measurement mode: [IMRMS]
To acquire measured-value mode data: [IM?]
The relevant response message: [IMRMS]
To read output current: [IOUT?]
The relevant response message: [IOUT 10.0]
(for 10 A output current)

Sample program (for IB11-PCR-L)

```
:
100 ADR = 1                              'IB11-PCR-L address
110 ISET IFC:ISET REN:CMD DELIM=0         'Initializes PC-9801.
120 PRINT @ADR;"HEAD OFF"                'Sets the header to OFF.
130 PRINT @ADR;"OUT OFF"                 'Sets output to OFF.
140 PRINT @ADR;"IMPKH"                   'Selects the peak holding
                                          current measurement.
150 PRINT @ADR;"PEAKINIT"                'Clears peak current value.
160 '***** Time waiting for peak current value to be cleared *****
170 FOR I=1 TO 2
180 PRINT @ADR;"STS?"                    'Reads back status register
                                          content.
190 INPUT @ADR;RESP$
200 STS=VAL (RESP$) AND 4
210 IF STS<>4 THEN GOTO 180              'Measurement completion check
220 PRINT @ADR;"IOUT  ?"                 'For clearing the status
                                          register
230 INPUT @ADR;RESP$                     'Executes a dummy command.
240 NEXT I
250 '***** Rush current measurement *****
260 PRINT @ADR;"OUT ON"                  'Sets output to ON.
270 PRINT @ADR;"IOUT  ?"                 'For clearing the status
                                          register
280 INPUT @ADR;RESP$                     'Executes dummy command.
290 IPMAX=0
300 PRINT @ADR;"STS?"                    'Reads back status register
                                          content.
310 INPUT @ADR;RESP$
320 STS=VAL(RESP$) AND 4
330 IF STS<>4 THEN GOTO 300              'Measurement completion check
340 PRINT @ADR;"IOUT  ?"                 'Reads back the peak holding
                                          current value.
350 INPUT @ADR;RESP$
360 IPKH=VAL(RESP$)
370 IF IPMAX<IPKH THEN IPMAX=IPKH:GOTO 300
                                         'Repeats the operation while
                                          data is updated.
380 PRINT "Rush current is" ;RESP$; "A."
390 PRINT @ADR;"OUT OFF"                 'Sets output to OFF.
400 END
```

Sample program (for RS11-PCR-L)

```
:
100 ADR = 1                              'RS11-PCR-L address
110 OPEN "COM1:N81NN" AS #1              'Initializes PC-9801.
120 PRINT #ADR,"HEAD OFF"                'Sets the header to OFF.
130 PRINT #ADR,"ACDC  ?"                 'Reads back the AC/DC mode.
140 INPUT #ADR,RESP$
150 ACDC=VAL(RESP$)
160 PRINT #ADR,"IMRMS"                   'rms current measurement
170 PRINT #ADR,"IOUT  ?"
180 INPUT $ADR,RESP$
190 IRMS=VAL(RESP#)
200 PRINT #ADR,"IMPK"                    'Peak current measurement
210 PRINT #ADR,"IOUT  ?"
220 INPUT #ADR,RESP$
230 IPK=VAL(RESP$)
240 IF ACDC=0 THEN GOTO 290              'Average value measurement in
                                          any mode other than AC mode
250 PRINT #ADR,"IMAVE"
260 PRINT #ADR,"IOUT  ?"
270 INPUT #ADR,RESP$
280 IAVE=VAL(RESP$)
290 PRINT #ADR,"IMRMS:
300 CLS                                  'Measured value display
310 IF ACDC=0 THEN AD$="AC"
320 IF ACDC=1 THEN AD$="DC"
330 IF ACDC=2 THEN AD$="AC+DC"
340 PRINT "AC/DC mode is" ;AD$;"."
350 PRINT
360 PRINT " Irms  = ";IRMS
370 IF ACDC=0 THEN 390
380 PRINT " Iave  = ";IAVE
390 PRINT " Ipeak = ";IPK
400 END
```

5.5.3 Power, Voltampere, and Power-Factor Measurement ([WATT?], [VA?], and [PF?])

The GP-IB Interface/RS-232C Interface allows measurement of power, voltampere, and power-factor of the output regardless of voltage/current measurement mode. These items can be measured only when a load is connected to the PCR-L AC Power Supply. (For information about power measurement, see the PCR-L AC Power Supply Operation Manual.)

Voltampere Measurement

Voltampere is calculated from the voltage and current measured-rms values. It can be read out using the [VA?] command.

Power-Factor Measurement

Power-factor is calculated from the measured watt value and measured VA value. It can be read out using the [PF?] command.

Sample program (for IB11-PCR-L)

```
:
100 ADR = 1                                 'IB11-PCR-L address
110 ISET IFC:ISET REN:CMD DELIM=0            'Initializes PC-9801.
120 PRINT @ADR;"HEAD OFF"                   'Sets the header to OFF.
130 PRINT @ADR;"WATT  ?"                    'Reads back power.
140 INPUT @ADR;RESP$
150 WATT=VAL(RESP$)
160 PRINT @ADR;"VA  ?"                      'Reads back voltampere.
170 INPUT @ADR;"RESP$
180 VA=VAL(RESP$)
190 PRINT @ADR;"PF  ?"                      'Reads back power factor.
200 INPUT @ADR;RESP$
210 PF=VAL(RESP$)
220 CLS                                     'Measured value display
230 PRINT
240 PRINT " WATT = ";WATT
250 PRINT " VA   = ";VA
260 PRINT " PF   = ";PF
270 END
```

Sample program (for RS11-PCR-L)

```
:
100 ADR = 1                              'RS11-PCR-L address
110 OPEN "COM1: N81NN" AS #1             'Initializes PC-9801.
120 PRINT #ADR,"HEAD OFF"                'Sets the header to OFF.
130 PRINT #ADR,"WATT  ?"                 'Reads back power.
140 INPUT #ADR,RESP$
150 WATT=VAL(RESP$)
160 PRINT #ADR,"VA  ?"                   'Reads back voltampere.
170 INPUT #ADR,RESP$
180 VA=VAL(RESP$)
190 PRINT #ADR,"PF  ?"                   'Reads back power factor.
200 INPUT #ADR,RESP$
210 PF=VAL(RESP$)
220 CLS                                  'Measured value display
230 PRINT
240 PRINT " WATT  = ";WATT
250 PRINT " VA    = ";VA
260 PRINT " PF    = ";PF
270 END
```

5.5.4 Harmonic Current Analysis ([FFT], [CURHARMA?], [CURHARMP?], and [FFTHOLD])

The GP-IB Interface/RS-232C Interface allows harmonic output current analysis. Unlike conventional methods, use of this device requires no FFT analyzer.
Enter into the harmonic analysis mode using the [FFT] command, then read data using the [CURHARMA?] or [CURHARMP?] command. Once the harmonic analysis mode has been entered after receiving the [FFT ON] command, the GP-IB Interface/RS-232C Interface accepts only the following message and commands.

- Query message
- [OUT] command
- [VSET] command
- [ACVSET] command
- [FSET] command
- [CURHARMA?] and [CURHARMP?] command
- [FFT OFF] command

To exit the harmonic analysis mode, use the [FFT OFF] command.
The difference between [CURHARMA?] and [CURHARMP?] is as follows:
[CURHARMA?]: Indicates the harmonic component at each order as a current value.
[CURHARMP?]: Indicates the percentage of a harmonic current value with the current value of the fundamental wave component regarded as 100%.

The command formats are as shown below.

Harmonic current analysis command	Response data
[CURHARMA N?] [CURHARMP N?]	Returns N-th order harmonic data only.
[CURHARMA ODD?] [CURHARMP ODD?]	Returns odd-number order harmonic data, delimiting them with ",".
[CURHARMA EVEN?] [CURHARMP EVEN?]	Returns even-number order harmonic data, delimiting them with ",".
[CURHARMA LOW?] [CURHARMP LOW?]	Returns 1st to 20th order harmonic data, delimiting them with ",".
[CURHARMA HIGH?] [CURHARMP HIGH?]	Returns 21st to 40th order harmonic data, delimiting them with ",".

The [FFTHOLD] command is used for pausing FFT calculation to hold harmonic analysis data. Entering into the pause status causes the current data to be held. When a pause is canceled, data is updated whenever measurement ends.

Pause command	Pause status
[FFTHOLD ON] [FFTHOLD 1]	Paused
[FFTHOLD OFF] [FFTHOLD 0]	Pause canceled

Examples: To measure the 3rd order harmonic value as current value [CURHARMA 3?]
To measure the 5th order harmonic current in percentage [CURHARMP 5?]

[Description] The harmonic analysis measurement cycle varies with output frequency (approximately 1 second to 4 seconds). During this measurement cycle, the same data is returned even if the [CURHARMA?] command is received repeatedly. Use of the status register DAV bit (bit 2) allows you to perform effective programming.

Sample program (for RS11-PCR-L)

```
:
100 ADR = 1                              'RS11-PCR-L address
110 OPEN "COM1:N81NN" AS #1              'Initializes PC-9801.
120 PRINT #ADR,"HEAD OFF"                'Sets the header to OFF.
130 PRINT #ADR,"FFT ON"
140 PRINT #ADR,"CURHARMA LOW?"
150 LINE INPUT #ADR,RESP$
160 PRINT RESP$
170 PRINT #ADR,"CURHARMA HIGH?"
180 LINE INPUT #ADR,RESP$
190 PRINT RESP$
200 END
```

5.6 Limit Value Setting Commands

5.6.1 Voltage Limit Setting ([ACVLO], [ACVHI], [DCVLO], and [DCVHI])

The [ACVLO], [ACVHI], [DCVLO], and [DCVHI] commands are used to read voltage limit setting. (For information on the voltage limits, see the PCR-L AC Power Supply Operation Manual.)

	Program message	Query message	Setting at factory shipment
Low AC voltage limit	[ACVLO]	[ACVLO?]	0.0V
High AC voltage limit	[ACVHI]	[ACVHI?]	305.0V
Low DC voltage limit	[DCVLO]	[DCVLO?]	-431.0V
High DC voltage limit	[DCVHI]	[DCVHI?]	431.0V

5.6.2 Frequency Limit Setting ([FLO], [FHI])

The [FLO] and [FHI] commands are used to read out the frequency limit setting. (For information on the frequency limits, see the PCR-L AC Power Supply Operation Manual.)

	Program message	Query message	Setting at factory shipment
Low frequency limit	[FLO]	[FLO?]	1.00Hz
High frequency limit	[FHI]	[FHI?]	999.9Hz

5.6.3 Current Limit Setting ([ACILIM], [DCILIM])

The [ACILIM] and [DCILIM] commands are used to read out the current limit setting. (For information on the current limits, see the PCR-L AC Power Supply Operation Manual.)

	Program message	Query message	Setting at factory shipment
Low AC current limit	[ACILIM]	[ACILIM?]	1.1 times the rating
High AC current limit	[DCILIM]	[DCILIM?]	1.1 times the rating

Sample program (for IB11-PCR-L)

```
:
100 ADR = 1                              'IB11-PCR-L address
110 ISET IFC:ISET REN:CMD DELIM=0         'Initializes PC-9801.
120 PRINT @ADR;"ACVLO 0V"                'Low AC voltage limit    0 V
130 PRINT @ADR;"ACVHI 132V"              'High AC voltage limit   132 V
140 PRINT @ADR;"FLO 47HZ"                'Low frequency limit     47 Hz
150 PRINT @ADR;"FHI 63HZ"                'High frequency limit    63 Hz
160 PRINT @ADR;"DCVLO 0V"                'Low DC voltage limit    0 V
170 PRINT @ADR;"DCVHI 0V"                'High DC voltage limit   0 V
180                                      'DC voltage other than   0 V
                                          can no longer be set.
190 PRINT @ADR;"ACILIM 3.0A"             'Current limit           3 A
200 END
```

Sample program (for RS11-PCR-L)

```
:
100 ADR = 1                              'RS11-PCR-L address
110 OPEN "COM1:N81NN" AS #1              'Initializes PC-9801.
120 PRINT #ADR,"ACVLO 0V"                'Low AC voltage limit    0 V
130 PRINT #ADR,"ACVHI 132V"              'High AC voltage limit   132 V
140 PRINT #ADR,"FLO 47HZ"                'Low frequency limit     47 Hz
150 PRINT #ADR,"FHI 63HZ"                'High frequency limit    63 Hz
160 PRINT #ADR,"DCVLO 0V"                'Low DC voltage limit    0 V
170 PRINT #ADR,"DCVLO 0V"                'High DC voltage limit   0 V
180                                      'DC voltage other than   0 V
                                          can no longer be set.
190 PRINT #ADR,"ACILIM 3.0A"             'Current limit           3 A
200 END
```

5.7 Memory Setting Commands

The PCR-L AC Power Supplies allow nine sets of voltage and frequency settings to be stored in the memory (memory addresses 1 to 9) without connecting the GP-IB Interface/RS-232C Interface. This data can be read for output as necessary.

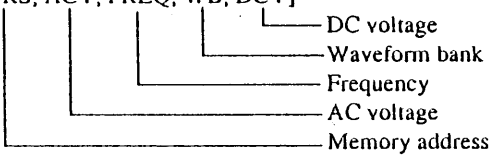
When this interface is connected, the number of set values that can be written in the memory (the number of memory addresses) increases to 99. The device allows only writing to the memory. Memory addresses 1 to 9 are shared for set values from the control panel and those from the interface board.

To run data stored in the memory, use the PCR-L AC Power Supply or RC02-PCR-L Remote Controller. (Running of memory data cannot be achieved via the interface board.)

5.7.1 Memory Setting ([MEMSTO])

This command is used to specify all data settable in the memory for writing to the memory. The command format is as follows:

[MEMSTO] [SP] [ADRS, ACV, FREQ, WB, DCV]



Examples: To store 100 V AC, 50 Hz, waveform bank 0, and 0 V DC to address 5
MEMSTO 5, 100, 50, 0, 0
To store 2 V AC, 3 Hz, waveform bank 4, and 5 V
DC to address 1 MEMSTO 1, 2, 3, 4, 5
To read memory data using the [MEMSTO?] command
[MEMSTO] [SP] [ADRS ?]
Memory address

To read the content of address 5 MEMSTO 5?
The relevant response message MEMSTO 5,100,50,0,0

Sample program (for IB11-PCR-L)

```
:
100 ADR = 1                                'IB11-PCR-L address
110 ISET IFC:ISET REN:CMD DELIM=0           'Initializes PC-9801.
120 PRINT @ADR;"SETINI"                    'Initializes IB11-PCR-L.
130 PRINT @ADR;"CLRMEMORY"                 'Clears memory set values.
140 PRINT @ADR;"FSET 60HZ"                 'Stores 60 Hz in address 1.
150 PRINT @ADR;"FSTO 1"
160 PRINT @ADR;"VSET 110V"                 'Stores 110 V in address 1.
170 PRINT @ADR;"VSTO 1"
180 PRINT @ADR;"MEMSTO 2, 90, 50, 0, 0" 'Stores 110V and 50 Hz in
                                               address 2.
200 END
```

Sample program (for RS11-PCR-L)

```
:
100 ADR = 1                                'RS11-PCR-L address
110 OPEN "COM1:N81NN" AS #1                'Initializes PC-9801.
120 PRINT #ADR,"SETINI"                    'Initializes RS11-PCR-L.
130 PRINT #ADR,"CLRMEMORY"                 'Clears memory set values.
140 PRINT #ADR,"FSET 60HZ"                 'Stores 60 Hz in address 1.
150 PRINT #ADR,"FSTO 1"
160 PRINT #ADR,"VSET 110V"                 'Stores 110 V in address 1.
170 PRINT #ADR,"VSTO 1"
180 PRINT #ADR,"MEMSTO 2, 90, 50, 0, 0"
                                           'Stores 110V and 50 Hz in
                                            address 2.
190 END
200 END
```

5.7.2 AC Voltage and Frequency Setting Individually ([VSTO], [FSTO])

The [VSTO] command writes the set output voltage in the memory; the [FSTO] command writes the set frequency in the memory. This does not cause other set values to change. The command formats are as shown below.

[VSTO] [SP] [ADRS]
└——— Memory address
[FSTO] [SP] [ADRS]
└——— Memory address

Examples: To change the AC voltage in address 5 to 110 V. ACVST 110 VSTO 5
To read the AC voltage or frequency set value only, use the [VSTO?] or [FSTO?] command.

[VSTO] [SP] [ADRS?]
└——— Memory address
[FSTO] [SP] [ADRS?]
└——— Memory address

To read AC voltage in address 5
VSTO 5?
The relevant response message
VSTO 5,100.0V

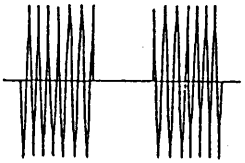
5.7.3 Memory Content Erasure ([CLRMEMORY])

This command returns the memory content to the factory shipment (default) status. The factory shipment status is as follows:

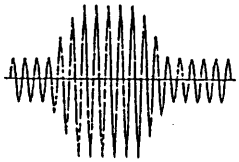
ACV : All AC voltages are 0 V.
WB : All waveform banks are 0.
DCV : All DC voltages are 0 V.
FREQ : Frequency is 50, 60, or 400 Hz.

5.8 Power Line Abnormality Simulation Commands

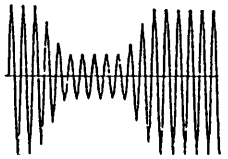
These commands are used to cause instantaneous power line interruption, fast voltage decrease (DIP), or fast voltage increase (POP) in output of the PCR-L AC Power Supply. This enables the equipment to perform power line abnormality simulation.



Power line interruption



Fast voltage decrease (DIP)



Fast voltage increase (POP)

To perform this simulation, select the power line abnormality simulation mode (set the power line abnormality simulation mode to ON), then set parameters.

5.8.1 Power Line Abnormality Simulation Mode ON/OFF ([SIMMODE])

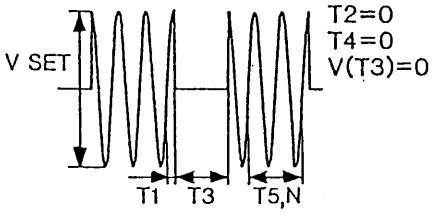
The [SIMMODE] command is used to control ON/OFF of power line abnormality simulation mode. The [SIMMODE] command is available only when output is OFF.

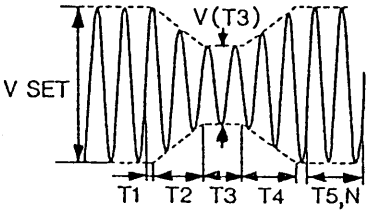
[SIMMODE OFF] command	Power line abnormality simulation mode	
[SIMMODE OFF] [SIMMODE 0]	OFF	(Setting at POWER ON)
[SIMMODE ON] [SIMMODE 1]	ON	

In the power line abnormality simulation mode, there are restrictions on the commands that can be accepted. The commands available in the power line abnormality simulation mode are listed in the table below.

For output OFF	For output ON
T1, T1DEG, T2	SIMRUM SIMSTOP
T3, T4, T5	RUNNING INT, OUT
N, RPT, POL	Query message
T3VSET SIMMODE OFF	
RUNNING OUT FSET	
VSET, ACVSET	
Query message	

The power line abnormality simulation parameters are as follows:





T1: **Voltage change start time (phase)**
Time or phase before starting the change.
Time or phase form the point that the waveform crosses the zero level to the starting point of abnormal change, such as voltage increase or decrease.
Select ms or deg. as the unit.

T2: **Slope time 1**
Interval of time for the voltage to increase (POP) or decrease (DIP) from the initial value to the final value specified as abnormal voltage.

T3: **Voltage change duration**
Interval of the time which elapses from the end of previous voltage change to the beginning of the next voltage change the voltage is maintained for Variation Voltage during the interval.
Specifying zero (0) for this T3 disables this function.

T4: **Slope time 2**
Interval of time for the voltage to increase (POP) or decrease (DIP) from the value specified as abnormal voltage (Variation Voltage) to the initial value.

T5: **Restoration duration**
The time during the condition that the voltage recovered to the initial value and has been maintained.

N: **Restoration cycle**
The number of cycles during the condition that the voltage recovered to the initial value and has been maintained. The number of cycles should be specified at current frequency.

V (T3): **Variation voltage**
The final voltage value increased (POP) or decreased (DIP). This value is specified at the interval of T3.

RPT: **Repetition count**
Indicates the number of repetitions for T1 to T5 (N).

- For items T5 or N, specify one of them.
- When T5 is set to other than an integral multiple of 1 cycle, the real restoration duration gets longer than the set T5 time because the voltage change is started after the waveform crossed the zero level.

5.8.2 Parameter Commands

Voltage change start time/phase setting ([T1], [T1DEG])

The [T1] or [T1DEG] command sets the time or phase where the voltage starts to change.

[T1] command : Start time
[T1DEG command] : Phase

The last set of either [T1] or [T1DEG] parameter becomes effective. If the unit for time program data is omitted, seconds is used.

Slope time 1 setting ([T2])
The [T2] command sets the time (variation time) during which output voltage reaches variation voltage V (T3). If the unit for time program data is omitted, seconds is used.

Voltage change time setting ([T3])
The [T3] command sets the time for which output voltage is maintained at variation voltage V (T3). If this value is 0, power line abnormality simulation does not start.
If the unit for time program data is omitted, seconds is used.

Slope time 2 setting ([T4])
The [T4] command sets the time during which output voltage returns from variation voltage V (T3) to the original voltage. If the unit for time program data is omitted, seconds is used.

Restoration duration/restoration cycle setting ([T5], [N])
The [T5] or [N] command sets the time or the number of voltage waveform cycles required between the instant that output voltage returns to the original voltage and the instant that the next power line abnormality simulation starts. That is, the [T5] command sets restoration duration, and the [N] command sets restoration cycle.
If restoration duration is set, the GP-IB Interface/RS-232C Interface internally converts the duration into a restoration cycle count based on the frequency applied at the time. Therefore, the difference between setting of the restoration time and the resultant restoration time is a maximum of a single cycle.
If the unit for time program data is omitted, seconds is used.

Repetition count setting ([RPT])
The RPT command sets the number of repetitions of operations from T1 to T5. Setting 9999 causes infinite repetition.

Start polarity setting ([POL])
The POL command sets voltage polarity for starting power line abnormality simulation.

Polarity setting commands	Start polarity
[POL PLUS] [POL 0]	Positive polarity
[POL MINUS] [POL 1]	Negative polarity

(Setting at factory shipment)

Variation voltage setting ([T3VSET])
The [T3VSET] command sets variation voltage V (T3). The relationship between this value and the output voltage set value determines simulation operation as follows:

- Variation voltage (T3) > Output voltage set-value → Fast voltage rise (pop)
- Variation voltage (T3) < Output voltage set-value → Fast voltage drop (dip)
- Variation voltage (T3) = 0 V → Power line interruption

5. 8. 3 Simulation Start/Stop ([INT], [SIMRUM], [SIMSTOP], [RUNNING?])

These commands are used to start or end power line abnormality simulation.

Power line abnormality simulation start/stop commands	Power line abnormality simulation status
[INT 0] [INT OFF] [SIMSTOP]	Stop
[INT 1] [INT ON] [SIMRUN]	Start

(Setting at POWER ON)

Whether power line abnormality simulation is running can be determined using the [RUNNING?] command. If the response message is [001], the simulation is running; if [000], the simulation has ended.

[Description] During the execution of power line abnormality simulation, only the following message and commands are accepted.

- Query message
- Commands that stop power line abnormality simulation [SIMSTOP], [INIT OFF], [INIT 0]

[Description] The Power Line Abnormality Simulation Setting Sheet included in this Operation Manual is useful for recording power line abnormality simulation.

Sample program (for IB11-PCR-L)

```
:
100 ADR = 1                              'IB11-PCR-L address
110 ISET IFC:ISET  REN:CMD DELIM=0        'Initializes PC-9801.
120 PRINT @ADR;"SETINI"                  'Initializes IB11-PCR-L.
130 PRINT @ADR;"SIMMODE ON"              'Simulation mode ON
140 PRINT @ADR;"T1DEG 90DEG"             'T1DEG              90deg
150 PRINT @ADR;"T2 0mS"                  'T2                 0mS
160 PRINT @ADR;"T3 5mS"                  'T3                 5mS
170 PRINT @ADR;"T4 0mS"                  'T4                 0mS
180 PRINT @ADR;"T5 1S"                   'T5                 1 sec
190 PRINT @ADR;"RPT 60"                  'Repetition count   60
200 PRINT @ADR;"T3VSET 0V"               'T3 voltage         0V
210 PRINT @ADR;"ACVSET 100V              'Set voltage        100V
220 PRINT @ADR;"FSET 47Hz"               'Frequency          47Hz
230 PRINT @ADR;"OUT ON:                  'Output ON
240 PRINT @ADR;"SIMRUN"                  'Simulation start
```

5.9 Sequence Operation Commands

Specifying sequence operation by combining output voltage, frequency, time setting, and other factors allows the PCR-L AC Power Supply to perform automatic operation. To conduct sequence operation, write setting parameters, such as voltage, frequency, and other factors, and address set-up time in the sequence addresses (0 to 99 steps), then specify the following three items.

- Sequence start address
- Sequence end address
- Sequence repetition count (number of loops)

Caution

Some sequence operation commands are ignored in the AC or DC mode. In the AC + DC mode, however, all the commands are available.

5.9.1 Sequence Data Setting ([SEDIT])

Caution

Displayed output voltage/current value is calculated from data obtained by sampling of the output voltage/current. There are following three sampling methods for set-frequency. When you set the output frequency which goes across following three frequency-ranges in the sequence mode, sampling method is fixed in the method for the highest frequency in frequencies which you have set. When you set address set-up time which did not meet the measurement cycle in sequence setting, waveform of the address is not measured correctly.

1. Set-frequency is between ≥1 Hz and <16 Hz.
   256 points are sampled in one period of waveform as actual time. Because data for calculation are obtained in one period of waveform, measurement cycle is one period.

2. Set-frequency is between ≥16 Hz and <256 Hz.
   16 points are sampled in one period of waveform. This sampling is repeated 16 times, and 256 points of data are obtained. Because 16 periods of waveform is required to obtain data for calculation, measurement cycle is 16 periods.

3. Set-frequency is between ≥256 Hz and <1 kHz
   One point is sampled in one period of waveform. This sampling is repeated 256 times, and 256 points of data are obtained. Because 256 periods of waveform is required to obtain data for calculation, measurement cycle is 256 periods.

The [SEDIT] command sets sequence data. The command format is as shown below:

[SEDIT] [SP] [ADRS, R(F), FRQ, R(ACV), ACV, H, M, S, WB, OUTZ, DCV, STAT, TRG, OUT]

ADRS : Sequence address (NR2)
R (F) : Frequency change method Step/ramp (NR1)
FRQ : Frequency (NR4)
R (ACV) : AC voltage change method Step/ramp (NR1)
ACV : AC voltage (NR4)
H : Hour (NR4)
M : Minute (NR4)
S : Second (NR4)
WB : Waveform bank (NR2)
OUTZ : Output impedance (NR4)
DCV : DC voltage (NR4)
STAT : Status signal (NR1)
TRG : Trigger signal (NR1)
OUT : Output ON/OFF (NR1)
(These parameters can be set within a single step.)

- Step/ramp setting is accomplished by setting ON or 1 for ramp (straight line) or OFF or 0 for step. Address 0 does not allow ramp ON specification. Ramp ON specification at the start address is ignored.
- Waveform bank can be set in the same way as the [WAVEBANK] command in 5. 10, Waveform Bank Selection. The waveform bank contents should be set in advance using the [WAVEPC] command.
- Output impedance should be set in the same way as the [OUTZ] command in 5.3, Operation Status Setting Commands.
- A status signal is used to set if it is issued to the "STAT" BNC connector at the upper rear part of the PCR-L AC Power Supply.
- A trigger signal is used to set if it is issued to the "TRIG" BNC connector at the upper rear part of the PCR-L AC Power Supply.

[Description] The Sequence Operation Setting Sheet provided in the appendix of this Operation Manual is useful for setting and/or recording sequence operation.

5.9.2 Start Address Setting ([SEQSTART])

The [SEQSTART] command is used to set a start address. Start address setting can be read using the [SEQSTART?] command.

5.9.3 End Address Setting ([SEQEND])

The [SEQEND] command is used to set an end address. End address setting can be read using the [SEQEND?] command.

5.9.4 Loop Count Setting ([SEQLOOP])

The [SEQLOOP] command is used to set a loop count. Loop count setting can be read using the [SEQLOOP?] command.

5.9.5 Sequence Start ([SEQRUN], [RUNNING?])

The [SEQRUN] command is used to start a sequence. To determine whether a sequence is running, use the [RUNNING?] command.
If the response message is 1, a sequence is running; if 0, the sequence has ended.

5.9.6 Sequence Stop ([SEQSTOP])

The [SEQSTOP] command is used to stop a sequence.

5.9.7 Sequence Pause ([SEQPAUSE])

The [SEQPAUSE] command is used to pause during a sequence.

[Description] During the execution of a sequence, only , the following message and commands are accepted.

- Query message
- Commands that stop sequence operation [SEQSTOP], [SEQPAUSE]

Sample program (for IB11-PCR-L)

```
:
100 ADR = 1                                    'IB11-PCR-L address
110 ISET IFC:ISET  REN:CMD DELIM=0              'Initializes PC-9801.
120 PRINT @ADR;"SETINI"                        'Initializes IB11-PCR-L.
130 '***** Sequence data setting *****
140 '                    Ad, Rf, FRQ, Rv, Vac, H, M, Sec, WB, Z, Vdc, STAT,
                         TRG, OUT
150 PRINT @ADR;"SEDIT 1, 0, 20, 0, 50, 0, 0, 0, 2, 00, 0, 0, 0, OFF, OFF, ON"
160 PRINT @ADR;"SEDIT 2, 1, 60, 1, 100, 0, 0, 0, 3, 00, 0, 0, 0, OFF, OFF, ON"
170 PRINT @ADR;"SEDIT 3, 0, 60, 0, 100, 0, 0, 0, 2, 00, 0, 0, 0, OFF, OFF, ON"
180 PRINT @ADR;"SEQEND 3"                      'End address 3
190 PRINT @ADR;"SEQSTART 1"                    'Start address 1
200 PRINT @ADR;"SEQLOOP 30"                    'Loop count 30
210 PRINT @ADR;"SEQRUN"                        'Sequence start
```

Sample program (for RS11-PCR-L)

```
:
100 ADR = 1                                    'RS11-PCR-L address
110 OPEN "COM1:N81NN" AS #1                    'Initializes PC-9801.
120 PRINT #ADR,"SETINI"                        'Initializes RS11-PCR-L.
130 '***** Sequence data setting *****
140 '                    Ad, Rf, FRQ, Rv, Vac, H, M, Sec, WB, Z, Vdc, STAT,
                         TRG, OUT
150 PRINT #ADR,"SEDIT  1, 0, 20, 0, 50, 0, 0, 0, 2, 00, 0, 0, 0, OFF, OFF, ON"
160 PRINT #ADR,"SEDIT  2, 1, 60, 1, 100, 0, 0, 0, 3, 00, 0, 0, 0, OFF, OFF, ON"
170 PRINT #ADR,"SEDIT  3, 0, 60, 0, 100, 0, 0, 0, 2, 00, 0, 0, 0, OFF, OFF, ON"
180 PRINT #ADR,"SEQEND 3"                      'End address 3
190 PRINT #ADR,"SEQSTART 1"                    'Start address 1
200 PRINT #ADR,"SEQLOOP 30"                    'Loop count 30
210 PRINT #ADR,"SEQRUN"                        'Sequence start
```

5.10 Special Waveform Commands

Use of the specified waveform commands allow output of waveforms other than sine waves.
A special waveform that can be output as standard is a peak-clipped waveform, where the peak of a sine wave is suppressed. Also, transferring waveform data to the GP-IB Interface/RS-232C Interface allows output of user-defined waveforms.
To output a special waveform, set the special waveform in the waveform bank in advance and select the desired waveform bank for output. The GP-IB Interface/RS-232C Interface has 15 waveform banks (banks 0 to 14). Waveform bank 0 stores the reference sine waveform, which cannot be rewritten. Waveform banks 1 to 14 are available for user-defined waveforms, the content which can be rewritten.

5.10.1 Peak Clipped Waveform Setting ([WAVEPC])

The [WAVEPC] command sets a peak-clipped waveform. This command is available only when output is OFF. The command format is as shown below:

[WAVEPC] [SP] [WV,PC]
- PC: Peak-clipped wave crest factor (Crest factor = Peak value/rms value = 1.10 to 1.40)
- WV: Waveform bank (1 to 14)

Sample program (for IB11-PCR-L)

```
:
100 ADR = 1                                  'IB11-PCR-L address
110 ISET IFC:ISET  REN:CMD DELIM=0            'Initializes PC-9801.
120 PRINT @ADR;"OUT OFF"                     'Output OFF
130 FOR I=1 TO 14                            'Peak-clipped waveform setting
140 PRINT @ADR;"WAVEPC "+STR$(I)+","+STR$(1.1+(I-1)*.02)
150 NEXT I
160 END
```

Sample program (for RS11-PCR-L)

```
:
100 ADR = 1                                  RS11-PCR-L address
110 OPEN "COM1:N81NN" AS #1                  Initializes PC-9801.
120 PRINT #ADR,"OUT OFF"                     Output OFF
130 FOR I=1 TO 14                            Peak-clipped waveform setting
140 PRINT #ADR,"WAVEPC "+STR$(I)+","+STR$(1.1+(I-1)*.02)
150 NEXT I
160 END
```

5.10.2 Waveform Bank Selection ([WAVEBANK])

This command is used to select the desired waveform bank.

Sample program (for IB11-PCR-L)

```
:
100 ADR = 1                                          'IB11-PCR-L address
110 ISET IFC:ISET  REN:CMD DELIM=0                   'Initializes PC-9801.
120 CLS
130 INPUT "Enter the waveform bank number (0 to 14) to be selected."; WB
140 PRINT @ADR,"WAVEBANK "+STR$(WB)    'Waveform bank selection
150 GOTO 130
```

Sample program (for RS11-PCR-L)

```
:
100 ADR = 1                                          'RS11-PCR-L address
110 OPEN "COM1:N81NN" AS #1                          'Initializes PC-9801.
120 CLS
130 INPUT "Enter the waveform bank number (0 to 14) to be selected."; WB
140 PRINT #ADR,"WAVEBANK "+STR$(WB)    'Waveform bank selection
150 GOTO 130
```

5.10.3 User-Defined Waveform Data Write ([WAVE])

The [WAVE] command is used to directly write data in a waveform bank.

[WAVE] [SP] [WB, ADR, DATA]

- DATA — Waveform data (NR2)
- ADR — Waveform data address (NR2)
- WB — Waveform bank (NR1)

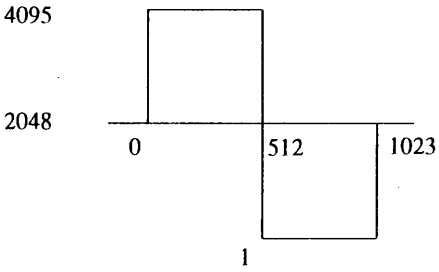
Waveform data address is an integer within the range of 0 to 1023, and it is treated as follows:

0 : Phase angle of 0 degree
512 : Phase angle of 180 degrees

Waveform data is an integer within the range of 0 to 4095, and it has the following meaning:

2048 : Center of waveform
1 : Negative peak
4095 : Positive peak

Example in which square wave is created
Horizontal direction : Waveform address
Vertical direction : Waveform data



Sample program (for IB11-PCR-L)

```
:
100 ADR = 1                                    'IB11-PCR-L address
110 ISET IFC:ISET  REN:CMD DELIM=0              'Initializes PC-9801.
120 PRINT @ADR;"OUT OFF"                       'Output OFF
130 FOR I=0 TO 511
140 PRINT @ADR;"WAVE 2,"+STR$(I)+",4095"       'Waveform data write
150 NEXT I                                     'Bank 1, addresses 0 to 511
160 FOR I=512 TO 1023
170 PRINT @ADR;"WAVE 2,"+STR$(I)+",1"          'Waveform data write
180 NEXT I                                     'Bank 1, addresses 512 to 1023
```

Sample program (for RS11-PCR-L)

```
:
100 ADR = 1                                    'RS11-PCR-L address
110 OPEN "COM1:N81NN" AS #1                    'Initializes PC-9801.
120 PRINT #ADR,"SILENT OFF"                    'Acknowledgement message ON
130 PRINT #ADR,"OUT OFF"                       'Output OFF
140 FOR I=0 TO 511
150 PRINT #ADR,"WAVE 2,"+STR$(I)+",4095"       'Waveform data write
160 INPUT #ADR,RESP$
170 NEXT I                                     'Bank 1, addresses 0 to 511
180 FOR I=512 TO 1023
190 PRINT #ADR,"WAVE 2,"+STR$(I)+",1"          'Waveform data write
200 INPUT #ADR,RESP$
210 NEXT I                                     'Bank 1, addresses 512 to 1023
220 PRINT #ADR,"SILENT ON"                     'Acknowledgement message
                                               OFF
```

[Description] Omission of Command

The GP-IB Interface/RS-232C Interface has a function that accepts a command message even if part of the command data is omitted. Omitted command data is automatically determined by one of the following two approaches, based on the type of command data.

(1) Incrementing command data (+1)

If command data that indicates an address or order is omitted, the device performs automatic incrementing (+1). The following are examples of this method.

- CURHARMAN? and CURHARMPN? commands
  Set harmonic order to N to read back a harmonic analyzed value. Once a command is executed with the harmonic order set to N, data of the next harmonic order is read back whenever the CURHARMA? or CURHARMP? command is executed.
- MEMSTO command
  Omission of address data (address-indication data) among multiple command data causes the address to be automatically increased.
- SEDIT command
  Omission of address data among multiple command data causes the address to be automatically increased.
- WAVE command
  Omission of waveform data's address data among multiple command data causes the address to be automatically increased.

(2) Making effective the data set so far or data set immediately before

- MEMSTO command
  Omission of data other than address data among multiple command data disables any change of the omitted data.
- SEDIT command
  Omission of data other than address data among multiple command data disables any change of the omitted data.
- WAVE command
  Omission of data other than waveform data's address data among multiple command data causes the waveform bank content set immediately before to apply.

If the GP-IB Interface receives a query message during GPIB communications, simply specifying the GP-IB Interface as a listener allows the device to send the response message repeatedly. This eliminates the need to send the same query message over and over and improves the program running rate. (Omission of command data also applies in this case.)

Chapter 6
SPECIFICATIONS

Lists the specifications of this equipment.

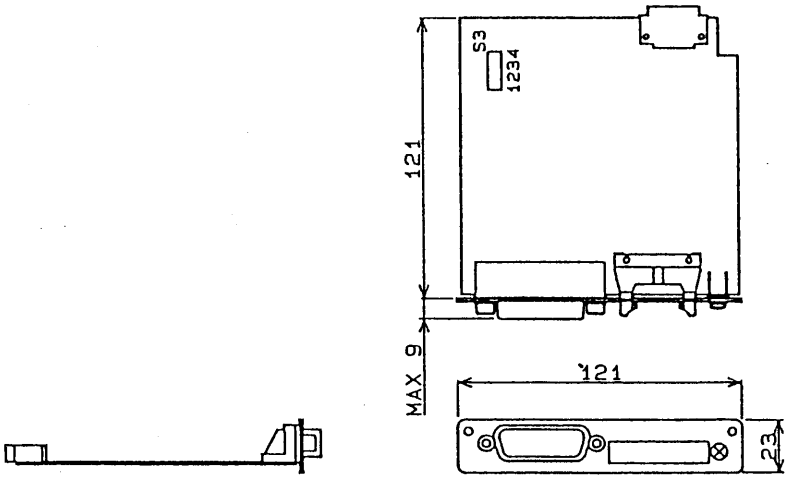
Contents

6.1 Specifications

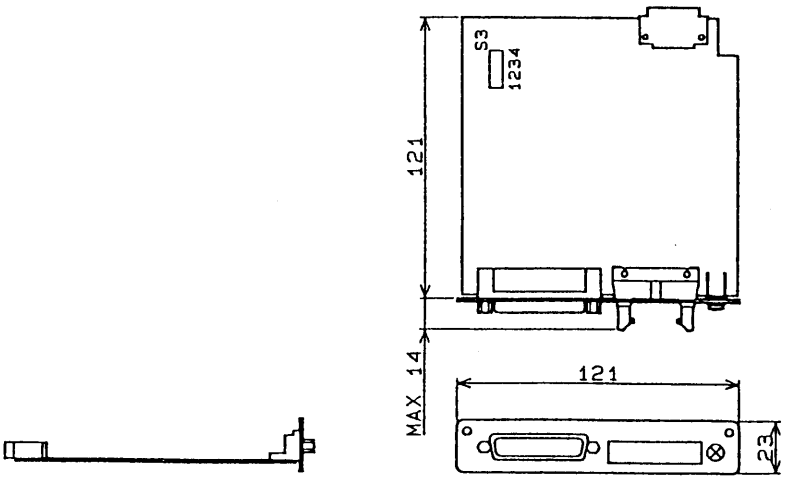
Item			Setting range	Resolution	Setting accuracy
Setting functions					
Power line abnormality simulation					
	T1	× 1 deg	0 deg to 360 deg	1 deg	For T2 = T4 = 0, 1 deg. For T2 ≠ 0 or T4 ≠ 0, 1 mS
		× 1 mS	0 mS to 999.9 mS	0.1mS	For T2 = T4 = 0, ±(1 x 10^{-3}+ 0.1 mS) For T2 ≠ 0 or T4 ≠ 0, ±(1 x 10^{-3}+ 1 mS)
	T2	× 1	0 mS to 9999 mS	1 mS	±(1 x 10^{-3}+ 1 mS)
		× 10	0.00 to 99.99 S		
	T3	× 1	0.0 mS to 999.9 mS	0.1 mS	For T2 = T4 = 0, ±(1 x 10^{-3}+ 0.1 mS) For T2 ≠ 0 or T4 ≠ 0, ±(1 x 10^{-3}+ 1 mS)
		× 10	0 mS to 9999 mS	1 mS	
	T4	× 1	0 mS to 9999 mS	1 mS	±(1 x 10^{-3}+ 1 mS)
		× 10	0.00 to 99.99 S		
	T5	× 1	0 mS to 9999 mS	1 mS	1 cycle
		× 10	0.00 to 99.99 S	10 mS	
	N	× 1	0 to 9999 cycles	1 cycle	1 cycle
		× 10	0 to 99990 cycles	10 cycles	
		× 100	0 to 999900 cycles	100 cycles	
	V(T3)		Same as output voltage setting range	0.1 V	—
	RPT		0 to 9998 times or ∞	Once	Once
Sequence operation					
	ADR		0 to 99	1	—
	FRQ		Same as output frequency setting range	Same as at the left	Same as at the left
	Vac		Same as output voltage setting range	Same as at the left	Same as at the left
	TIME	HOUR	0 hr to 999 hrs 59 min	1 min	±(1 x 10^{-3}+ 0.5 min)
		MIN	0 min to 999 min 59 sec	1 S	±(1 x 10^{-3}+ 0.5 S)
		SEC	0 sec or 999. 999 sec	1 mS	±(1 x 10^{-3}+ 0.5 mS)
	WAVE		Same as special waveform output	Same as at the left	—
	IMP		Same as output impedance	Same as at the left	Same as at the left
	Vdc		Same as output voltage setting range	Same as at the left	Same as at the left

Item			Setting range	Resolution	Setting accuracy
AC + DC mode					
	Voltage setting		AC voltage setting range is the same as that of AC mode. DC voltage setting range is the same as that of DC mode. However, the AC + DC voltage peak value should be within the DC voltage setting range.	Same as that of AC or DC mode	—
	Maximum current		Same as that of DC mode	—	—
	Power capacity		Same as that of DC mode	—	—
	Frequency		Same as that of AC mode	Same as at the left	—
Special waveform output					
	Waveform bank		0 to 14 (0 for read only)	0	—
	Crest factor		1.10 to 1.40	0.01	0.01
Output impedance setting					
	PCR500L	100 V range, 200 V range	0 Ω to 4.0 Ω 0 Ω to 16.0 Ω	40 m Ω 160 m Ω	± (20% + 80 m Ω) ± (20% + 320 m Ω)
	PCR1000L	100 V range, 200 V range	0 Ω to 2.0 Ω 0 Ω to 8.0 Ω	20 m Ω 80 m Ω	± (20% + 40 m Ω) ± (20% + 160 m Ω)
	PCR2000L	100 V range, 200 V range	0 Ω to 1.0 Ω 0 Ω to 4.0 Ω	10 m Ω 40 m Ω	± (20% + 20 m Ω) ± (20% + 80 m Ω)
	PCR4000L	100 V range, 200 V range	0 Ω to 0.5 Ω 0 Ω to 2.0 Ω	5 m Ω 20 m Ω	± (20% + 10 m Ω) ± (20% + 40 m Ω)
	PCR6000L	100 V range, 200 V range	0 Ω to 0.333 Ω 0 Ω to 1.333 Ω	3.33 m Ω 13.33 m Ω	± (20% + 6.67 m Ω) ± (20% + 26.67 m Ω)
Output ON/OFF phase setting			0 deg to 360 deg	1 deg	1 deg
Measurement function					
Harmonic current analysis					
	Arms indication		—	Same as that of ammeter	Same as that of ammeter
	% indication		—	0.1%	0.5%
Indicator					
	Voltampere measurement		—	0.01 VA minimum (changing with VA value)	Same as that of wattmeter
	Power-factor measurement		—	0.01	Same as that of wattmeter
	Peak holding current measurement		—	Same as that of peak-ammeter	Within ± (2% of r.d.g. + 16 d) (from 5% of maximum rated current to maximum rated peak current at normal temperature)

6.2 Dimensions



IB11



RS11

Unit: mm

APPENDIX

Contents

Appendix 1 Power Line Abnormality Simulation Operation Setting Sheet

PCR-L
TITLE _____ DATE _____ No. _____

No	T1	T2	T3	T4	T5/N	V(T3)	RPT	POL	MEMO

MEMO

Appendix 2 Sequence Operation Setting Sheet

PCR-L

TITLE _____ DATE _____ No. _____

START_____ END _____ LOOP _____

ADR	R	F	R	Vac	Th	Tm	Ts	WAVE	IMP	Vdc	STRT	TRG	OUT

MEMO

Appendix 3 Quick Command Reference

Data type

NR1	1 (ON) /0 (OFF)
NR2	Decimal
NR3	Hexadecimal
NR4	Real number
string	Alphanumeric characters (no control codes allowed)
sp	Space code (20H)
?	Character "?" (3FH)
,	Character "," (2CH)
FORMAT	Format data (shown separately)

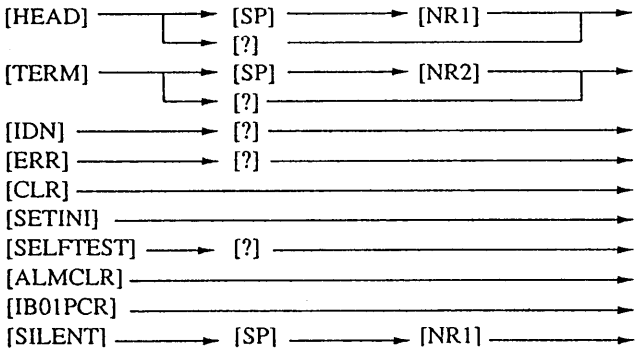
[1] System Commands

Header	Data type	Description	Setting range
HEAD	NR1	1: Assigns the header to response messages. 0: Assigns no header to response messages.	
HEAD?	NR1	Returns the data set using the HEAD command.	
TERM	NR2	0: Sets the response terminator to CRLF. 1: Sets the response terminator to CR. 2: Sets the response terminator to LF. 3: Sets the response terminator to EOI.	
TERM?	NR1	Returns the data set using the TERM command.	
IDN?	string	Returns a model number.	
ERR?	NR2	Returns an error code.	
CLR		Clears error register bits.	
SETINI		Selects the initial set-up status.	
SELFTEST?	FORMAT	Returns the self-test result.	
ALMCLR		Clears alarm.	
IB01PCR		Supports the IB0I-PCR commands.	
SILENT	NR1	Sets acknowledgement message ON/OFF.	

SELFTEST format data

```
SELFTEST OK
SELFTEST ADRxx, NOxx      xx=NR2
SELFTEST ADRxx, NOxx
SELFTEST ADRxx, NOxx
        :
        :
        :
```

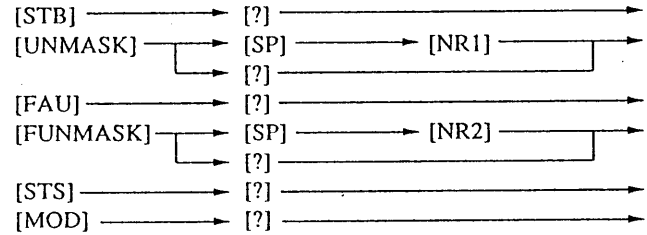
Command formats



[2] Register Related Commands

Header	Data type	Description	Setting range
STB?	NR2	Returns status byte register data.	
UNMASK	NR2	Sets unmask register data.	
UNMASK?	NR2	Returns unmask register data.	
FAU?	NR2	Returns fault register data.	
FUNMASK	NR2	Sets fault unmask register data.	
FUNMASK?	NR2	Returns fault unmask register data.	
STS?	NR2	Returns status register data.	
MOD?	NR2	Returns mode register data.	

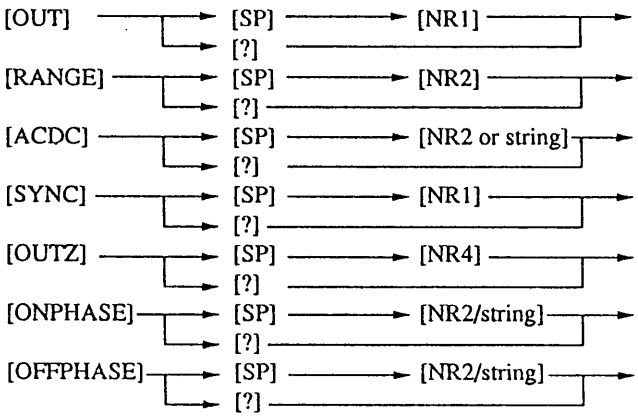
Command formats



[3] Operation Status Setting Commands

Header	Data type	Description	Setting range
OUT	NR1	Controls output ON/OFF.	
OUT?	NR1	Returns output status.	
RANGE	NR2	100: Sets output voltage range to 100 V range. 200: Sets output voltage range to 200 V range.	
RANGE?	NR2	Returns output voltage range.	
ACDC	NR2 string	0: Sets output voltage mode to AC. 1: Sets output voltage mode to DC. 2: Sets output voltage mode to AC + DC. AC: Sets output voltage mode to AC. DC: Sets output voltage mode to DC. ADC: Sets output voltage mode to AC + DC.	
ACDC?	NR2	Returns the data set using the ACDC command.	
SYNC	NR1	Controls synchronous operation ON/OFF.	
SYNC?	NR1	Returns the data set using the SYNC command.	
OUTZ	NR4	Sets output impedance.	See 5.3.5, Output Impedance Setting.
OUTZ?	NR4	Returns the data set using the OUTZ command.	
ONPHASE	NR2 string	Sets output ON phase. FREE: Cancels output ON phase.	0 to 360 [deg] Resolution: 1 [deg]
ONPHASE?	NR2 string	Returns output ON phase setting data. FREE: No output ON phase has been set.	
OFFPHASE	NR2 string	Sets output OFF phase. FREE: Cancels output OFF phase.	0 to 360 [deg] Resolution: 1 [deg]
OFFPHASE?	NR2 string	Returns output OFF phase setting data. FREE: No output OFF phase has been set.	

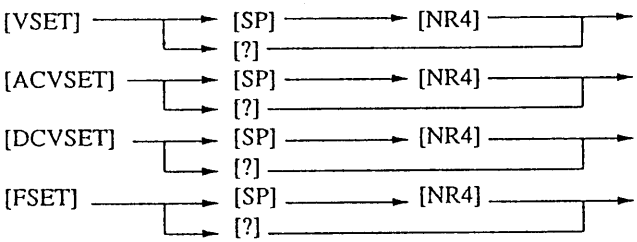
Command formats



[4] Output Voltage and Frequency Setting Commands

Header	Data type	Description	Setting range
VSET	NR4	Sets AC output voltage.	0 to152.5 [V]/ 0 to 305.0 [V] (Output 100 V/200 V range) Resolution: 0.1 [V]
VSET?	NR4	Returns an AC output voltage set-value.	
ACVSET	NR4	Sets AC output voltage.	0 to 152.5 [V]/ 0 to 305.0 [V] (Output 100 V/ 200 V range) Resolution: 0.1 [V]
ACVSET?	NR4	Returns an AC output voltage set-value.	
DCVSET	NR4	Sets DC output voltage.	0 to 215.5 [V]/ 0 to 431.0 [V] (Output 100 V/ 200 V range) Resolution: 0.1 [V]
DCVSET?	NR4	Returns a DC output voltage set-value.	
FSET	NR4	Sets frequency.	1.00 to 999.9 [Hz] Resolution: 0.01 [Hz]/0.1 [Hz]
FSET?	NR4	Returns a frequency set-value.	

Command formats



[5] Output Measurement Commands

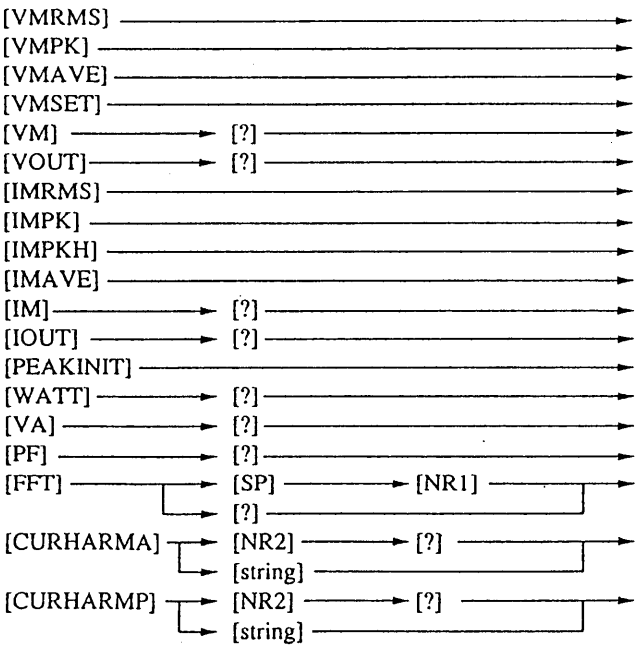
Header	Data type	Description	Setting range
VMRMS		Sets output voltage measurement mode to rms value.	
VMPK		Sets output voltage measurement mode to peak value.	
VMAVE		Sets output voltage measurement mode to average value.	
VMSET		Sets output voltmeter display mode to set-voltage display .	
VM?	string	Returns output voltage measurement mode data.	
VOUT?	NR4	Returns the measured output voltage value.	
IMRMS		Sets output current measurement mode to rms value.	
IMPK		Sets output current measurement mode to peak value.	
IMPKH		Sets output current measurement mode to peak-holding value.	
IMAVE		Sets output current measurement mode to average value.	
IM?	string	Returns output current measurement mode data.	
IOUT?	NR4	Returns the measured output current value.	
PEAKINIT		Clears the peak holding value.	
WATT?	NR4	Returns the measured output power value.	
VA?	NR4	Returns the measured output voltampere value.	
PF?	NR4	Returns the measured output power factor value.	
FFT	NR1	Selects the harmonic current analysis mode.	
FFT?	NR1	Returns a response indicating whether the harmonic current analysis mode has been selected.	
CURHAR-MA?	FORMAT	Returns the harmonic current analysis result as a current value.	
CURHAR-MP?	FORMAT	Returns the harmonic current analysis result as a percentage.	

CURHARMA and CURHARMP format data
For the detailed setting range, see 5.5.4, Harmonic Current Analysis.

Query message
CURHARMA xx?
└── Harmonic current order (NR2)

Response message
CURHARMA xx, xx
├── Harmonic analysis result (NR4)
└── Harmonic current order (NR2)

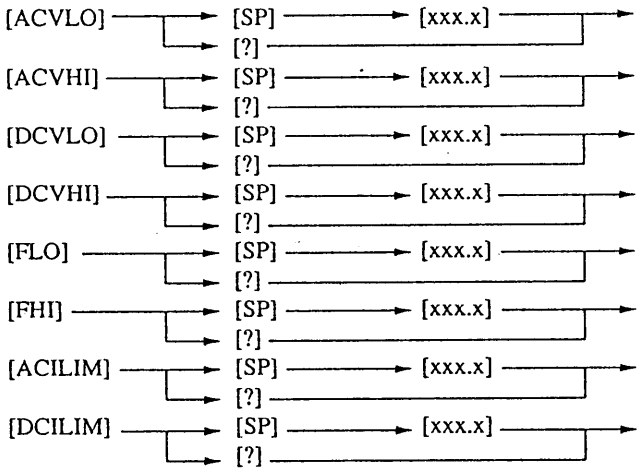
Command formats



[6] Limit Value Setting Commands

Header	Data type	Description	Setting range
ACVLO	NR4	Sets AC output voltage low limit.	0 ~305.0 [V] Resolution: 0.1 [V]
ACVLO?	NR4	Returns the AC output voltage low limit.	
ACVHI	NR4	Sets AC output voltage high limit.	0 ~305.0 [V] Resolution: 0.1 [V]
ACVHI?	NR4	Returns the AC output voltage high limit.	
DCVLO	NR4	Sets DC output voltage low limit.	-431.0~+431.0 [V] Resolution: 0.1 [V]
DCVLO?	NR4	Returns the DC output voltage low limit.	
DCVHI	NR4	Sets DC output voltage high limit.	-431.0~+431.0 [V] Resolution: 0.1 [V]
DCVHI?	NR4	Returns the DC output voltage high limit.	
FLO	NR4	Sets the output frequency low limit.	1.00~999.9 [Hz] Resolution: 0.01/0.1 [Hz]
FLO?	NR4	Returns the output frequency low limit.	
FHI	NR4	Sets the output frequency high limit.	1.00~999.9 [Hz] Resolution: 0.01/0.1 [Hz]
FHI?	NR4	Returns the output frequency high limit.	
ACILIM	NR4	Sets the AC output current limits.	10% to 110% of the maximum rated current (AC) (For PCR500L, 20% to 110%)
ACILIM?	NR4		
DCILIM	NR4	Returns the AC output current limits. Sets the DC output current limits.	10% to 110% of the maximum rated current (DC) (For PCR500L, 20% to 110%)
DCILIM?	NR4	Returns the DC output current limits.	

Command formats



[7] Memory Setting

Header	Data type	Description	Setting range
MEMSTO	FORMAT	Writes data in the memory.	Within output voltage and frequency setting ranges
MEMSTO?	FORMAT	Returns memory data.	
VSTO	NR2	Writes the currently set output voltage in the memory.	Within output voltage setting range
VSTO?	NR2	Returns memory voltage data.	
FSTO	NR2	Writes the currently set frequency in the memory.	Within output frequency setting range
FSTO?	NR2	Returns memory frequency data.	
CLRMEMORY	NR2	Erases all memory data.	

MEMSTO format data

Program and response messages

MEMSTO xx, xxx, xxx, xxx, xxx

xxx	DC voltage	(NR4)
xxx	Waveform bank	(NR2)
xxx	Frequency	(NR4)
xxx	AC voltage	(NR4)
xx	Address	(NR2)

Query message

MEMSTO xx?

xx — Address (NR2)

VSTO format data

Program message

VSTO xx

xx — Address (NR2)

Response message

VSTO xx, xxx

xxx	AC voltage	(NR4)
xx	Address	(NR2)

Query message

VSTO xx?

xx — Address (NR2)

FSTO format data

Program message

FSTO xx

xx — Address (NR2)

Response message

FSTO xx, xxx

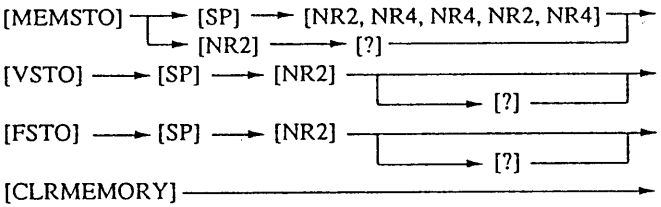
xxx	Frequency	(NR4)
xx	Address	(NR2)

Query message

FSTO xx?

xx — Address (NR2)

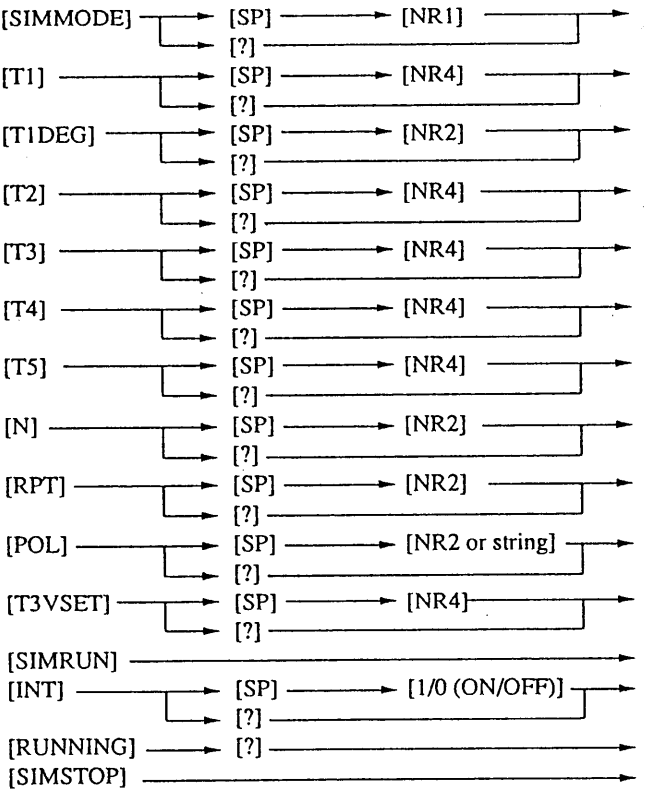
Command formats



[8] Power Line Abnormality Simulation Commands

Header	Data type	Description	Setting range
SIMMODE	NR1	Controls the simulation mode.	
T1	NR4	Sets voltage change start time.	0.0 to 999.9 (ms)
T1?	NR4	Returns voltage change start time.	
T1DEG	NR2	Sets voltage change start phase.	0 to 360 [deg]
T1DEG?	NR2	Returns voltage change start phase.	
T2	NR4	Sets slope time 1.	×1: 0 to 9999 [ms] ×10: 0.00 to 99.99 [s]
T2?	NR4	Returns slope time 1 data.	
T3	NR4	Sets voltage change duration.	×1: 0.0 to 999.9 [ms] ×10: 0 to 9999 [ms]
T3?	NR4	Returns voltage change duration data.	
T4	NR4	Sets slope time 2.	×1: 0 to 9999 [ms] ×10: 0.00 to 99.99 [s]
T4?	NR4	Returns slope time 2 data.	
T5	NR4	Sets restoration duration.	×1: 0 to 9999 [ms] ×10: 0.00 to 99.99 [s]
T5?	NR4	Returns restoration duration data.	
N	NR2	Sets restoration cycle.	×1: 0 to 9999 [ms] ×10: 0 to 99990 [ms] ×100: 0 to 999900 [ms]
N?	NR2	Returns restoration cycle data.	
RPT	NR2	Sets repetition count.	0 to 9998, ∞ (To set ∞, enter "9999.")
RPT?	NR2	Returns repetition count data.	
POL	NR2 NR2 string string	0: Sets voltage change start polarity to "+." 1: Sets voltage change start polarity to "-." PLUS: Sets voltage change start polarity to "+." MINUS: Sets voltage change start polarity to "-."	
POL?	NR2	Returns voltage change start polarity.	
T3VSET	NR4	Sets variation voltage.	Within output voltage setting range
T3VSET?	NR4	Returns variation voltage.	
SIMRUN		Executes simulation.	
INT	NR1	Controls simulation running/stop.	Running: 1, Stop: 0
INT?	NR1	Returns simulation running/stop status data.	
RUNNING?	NR1	Returns simulation running/stop status data.	
SIMSTOP		Stops simulation.	

Command formats



[9] Sequence Operation Commands

Header	Data type	Description	Setting range
SEDIT	FORMAT	Sets sequence data.	
SEDIT?	FORMAT	Returns sequence data.	
SEQSTART	NR2	Sets the start address.	1 to 98 *1
SEQSTART?	NR2	Returns start address data.	
SEQEND	NR2	Sets the end address.	1 to 99
SEQEND?	NR2	Returns end address data.	
SEQLOOP	NR2	Sets loop count.	1 to 99999
SEQLOOP?	NR2	Returns loop count data.	
SEQRUN		Runs a sequence.	
RUNNING?	NR1	Returns sequence running/stop status data.	
SEQSTOP		Ends a sequence.	
SEQPAUSE	NR1	Pauses a sequence.	Pause: 1, Re-start: 0
SEQPAUSE?	NR1	Returns sequence pause status data.	

*1 End address should be set less than start address.

SEDIT format data

Program and response messages

SEDIT XXX, X, XXX, X, XXX, XXX, XXX, XXX, XXX, XXX, XXX, X, X, X

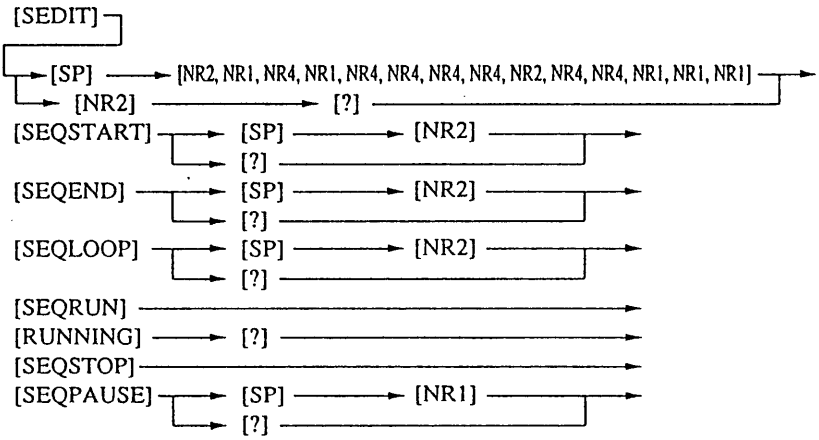
- Output (NR1)
- Trigger (NR1)
- Status (NR1)
- DC voltage (NR4)
- Impedance (NR4)
- Waveform bank (NR2)
- Second (NR4)
- Minute (NR4)
- Hour (NR4)
- AC voltage (NR4)
- Voltage ramp (NR1)
- Frequency (NR4)
- Frequency ramp (NR1)
- Address (NR2)

Address data start time setting range

(sec)	0~999.999
(min)	0~999
(hour)	0~999

Query message
SEDIT xx?
Address (NR2)

Command formats



[10] Special Waveform Commands

Header	Data type	Description	Setting range
WAVEPC	FORMAT	Sets peak-clipped waveform.	Crest factor: 1.10 to 1.40
WAVEPC?	FORMAT	Returns peak-clipped waveform set status data.	
WAVEBANK	NR2	Sets waveform bank.	1 to 14
WAVEBANK?	NR2	Returns waveform bank data.	
WAVE	FORMAT	Sets user-defined waveform.	
WAVE?	FORMAT	Returns user-defined waveform data.	

WAVEPC format data

Program and response messages

WAVEPC xx, xxx

- xx — Waveform bank
- xxx — Crest factor

Query message

WAVEPC xx?

- xx — Waveform bank

WAVE format data

Program and response messages

WAVE xx, xxxx, xxxx

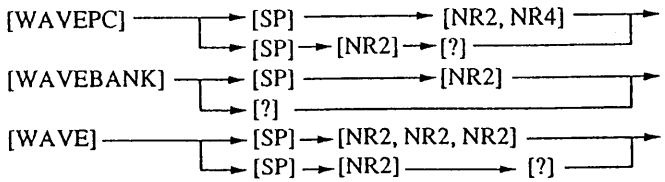
- xx — Waveform bank
- xxxx — Waveform address
- xxxx — Waveform data

Query message

WAVE xx?

- xx — Waveform bank

Command formats



Appendix 4 Guidance for Changing IB01-PCR Programs for Use on IB11-PCR-L

To use a program generated for an IB01-PCR on an IB11-PCR-L, some commands need to be rewritten for modification. This appendix describes how to modify these programs.

Program modification location	Modification method
Locations where response data is identified using a character string Example 1: For WORD 1 The OUT? result is identified using ON or OFF. The RANGE? result is identified using 100V or 200V. Example 2: For WORD 0 The OUT? result is identified using "1" or "0".	Modify the program so that all response data character strings are converted into numeric data for identification of response data. Example 1: An IB11-PCR-L has no WORD command. Convert response data from 001 or 000 into 1 or 0 for identification. Example 2: Since the response data is a three-digit character string, such as 001, convert a character string into a numeric value for identification.
Locations where a space is provided anywhere in a program message other than immediately after the program header. Example: V SET 100	Delete a space. Example: VSET 100
Locations where setting is initialized using the DC, SDC, or CLR command.	Change such commands into the SETINI command.
Locations where response data to the SYNC? command is used.	Change a response data identification section since an IB11-PCR-L has only two response data items for the SYNC? command; 001 (in synchronous operation) and 000 (not in synchronous operation).
Locations where the STATUS? command is used	Change the STATUS? command to the STB? or STS? command.

Program modification location	Modification method
Locations where the WORD command is used	The IB11-PCR-L has no WORD command and is fixed to WORD 0 status. Therefore, change all associated locations and delete the WORD command.
Locations where the UNMASK command is used	Change bit assignments to those of IB11-PCR-L.
Locations where the ERR? command is used	Change bit assignments to those of IB11-PCR-L.
T1, command	Change the T1, command to the T1 command and add SIMMODE ON (to be executed only once). Add unit mS. Set up OUT OFF, then execute the Tl command.
T2, command (same as the Tl, command)	Change the T2, command to the T2 command and add SIMMODE ON (to be executed only once). Add unit mS. Set up OUT OFF, then execute the T2 command.
T3, command (same as the T1, command)	Change the T3, command to the T3 command and add SIMMODE ON (to be executed only once). Add unit mS. Set up OUT OFF, then execute the T3 command.
T4, command (same as the T1, command)	Change the T4, command to the T4 command and add SIMMODE ON (to be executed only once). Add unit mS. Set up OUT OFF, then execute the T4 command.
N command	Add SIMMODE ON (to be executed only once). Set up OUT OFF, then execute the N command.

Program modification location	Modification method
POL command	Add SIMMODE ON (to be executed only once). Set up OUT OFF, then execute the POL command.
T3, VSET command	Change the T3,VSET command to the T3VSET command and add SIMMODE ON (to be executed only once). Set up OUT OFF, then execute the T3VSET command.
MODE command	The IB11-PCR-L has no MODE command; establishment of T2 = T4 = 0 and V (T3) = 0 accomplishes the same operation as that achieved using the MODE INT command. Change the MODE INT command into T2 0; T4 0; T3VSET 0 commands, and delete the MODE PD command.
VSET command	If SIMMODE ON is set, set up OUT OFF and then execute the VSET command.
FSET command	If SIMMODE ON is set, set up OUT OFF and then execute the FSET command.
INT command	Since parameter setting is accomplished when OUTPUT is OFF, set up OUT ON and then execute the INT command.
VLIM command	Change voltage upper limit setting to ACVHI.

INDEX

Comand List

Alphabetical order

(A)

(B)

(C)

(D)

(E)

(F)

(G)

(H)

(I)

(L)

(M)

(N)

(O)

(P)

(Q)

(R)

(S)

(T)

(U)

(V)

(W)

(Z)

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