Electronic Test
Instruments &
Power Supplies

GPIB INTERFACE

IB11

RS-232C INTERFACE

RS11

Operation Manual
PCR-W Series Edition

KIKUSUI

PART NO. Z1-000-962, IB000823

About this manual

We recommend that you read this manual thoroughly beforehand to ensure correct operation of the product. Be sure to store the manual in safe place so that you can use it whenever necessary. When the product is relocated, be sure to the operation manual be included.

SAFETY SYMBOLS

The following symbols are indicated where caution is especially required in handling the equipment.

Symbol	Description
WARNING	Indicates the existence of a personnel hazard. · Never fail to follow the operating procedure. Incorrect operating procedures may result in personal 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 operating procedure. Incorrect operating procedures may damage the equipment or other devices. · Do not proceed beyond a Caution sign until the indicated conditions are fully understood and met.
[Description]	Description and supplement

CONFIGURATION OF THE OPERATION MANUAL

This operation manual is configured as follows:

Chapter 1 GENERAL
Describes the features of the IB11/RS11 and preparation for use.

Chapter 2 INSTALLATION IN A PCR-W AC POWER SUPPLY
Describes how to install the IB11/RS11 in a PCR-W AC Power Supply.

Chapter 3 INITIAL SETTING
Explains how to accomplish the initial setting required for using the IB11/RS11.

Chapter 4 BASIC KNOWLEDGE
Presents basic information about of various messages needed to understand the IB11/RS11 commands.

Chapter 5 COMMAND MESSAGES DESCRIPTION
Describes command functions and formats.

Chapter 6 USING A PCR-W^2 IN THREE PHASE MODE
Describes the functions available in the three-phase mode of the PCR-W^2 AC Power Supplies that are different from those available in the single-phase mode.

Chapter 7 SPECIFICATIONS
Shows the specifications of the IB11/RS11.

APPENDIX
Contains the quick command reference sheets and sample programs.

CONTENTS

Chapter 1
GENERAL

Describes the features of the IB11/RS11 and preparation for use.

Contents

1.1 For PCR-W^2 AC Power Supply Users

The IB11 and the RS11 are also suitable for use with the PCR-W^2 AC Power Supplies. PCR-W^2 AC Power Supply users can read "PCR-W" as "PCR-W^2" in this manual for instructions on the use of such options.
To use the PCR-W^2 AC Power Supplies in the three-phase mode, read "Chapter 6 USING A PCR-W^2 IN THREE-PHASE MODE", which describes functions other them those for the single mode.

1.2 Outline

The IB11 is an interface board for GPIB communications; the RS11 is an interface board for RS-232C communications. Use of the IB11/RS11 with a PCR-W AC Power Supply significantly extends the PCR-W Series AC Power Supply functions.

1.3 Features

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

■Measurements of power-factor, VA, and peak holding current

The diverse measurement functions of the PCR-W AC Power Supplies can be extended by connecting the GPIB 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-W AC Power Supply receives a peak clear command.

■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-W AC Power Supply. Therefore, the PCR-W 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.

■AC + DC mode

This function allows the PCR-W 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.

■Expansion of the Memory Function

The PCR-W 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. Installing the IB11/RS11 enables the equipment to store up to 99 sets of voltage and frequency set values.
To output voltage and frequency set values stored using the IB11/RS11, use the PCR-W AC Power Supply or RC02-PCR-L Remote Controller. The IB11/RS11 has only input (write) capability.

1.4 To Use the Interface Function

To use the GPIB interface/RS-232C interface of the PCR-W AC Power Supply, the following optional hardwears are required.

■GPIB interface

- GPIB board : IB11
- GPIB interface cable : Complied with ANSI/IEEE std 488.1-1987

■RS-232C interface

- RS-232C board : RS11
- RS-232C interface cable : D-SUB 25P DTE connection cable
  (Normaly connected to a computer with cross type cable)

1.5 About This Operation Manual and ROM Version

This manual applies to the IB11/RS11 connected to a PCR-W 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-W AC Power Supply model number
- PCR-W AC Power Supply ROM version
- PCR-W AC Power Supply serial number and revision number (indicated on the lower rear part of the equipment)
- Interface board model number

* Before using this interface board, be sure to read the PCR-W AC Power Supply Operation Manual.

Chapter 2
INSTALLATION IN A PCR-W AC POWER SUPPLY

Describes the installation procedure.

Content

2.1 Check at Unpacking

This equipment was carefully tested and inspected both mechanically and electrically before shipment to ensure its normal operation.

The equipment should be checked upon receipt for damage that might have occurred during transportation. Also check if all accessories have been provided (see the following table). Should the equipment be damaged or any accessory missing, notify your Kikusui agent.

■IB11

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

■RS11

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

2.2 IB11/RS11 Handling Precautions

Always observe the following cautions in handling the IB11/RS11 interface board, since its PCB is exposed.

CAUTION

- 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 IB11/RS11 carton, promptly install the interface board in a PCR-W AC Power Supply.
- When storing the IB11/RS11 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 Installing the Interface Board into a PCR-W Slot

This interface board (IB11 or RS11) can be inserted into the PCR-W AC Power Supply extension slot (SLOT 1).

Installation procedure

CAUTION

- Before installing the IB11/RS11, always turn OFF the POWER switches of the PCR-W AC Power Supply and the computer that controls the IB11/RS11.

▶ Step 1 Remove a slot cover. (See Fig.1)

▶ Step 2 Hold the panel part of the IB11/RS11 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. (See Fig.2)

▶ 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-W AC Power Supply using the screws provided. This completes installation of the IB11/RS11.

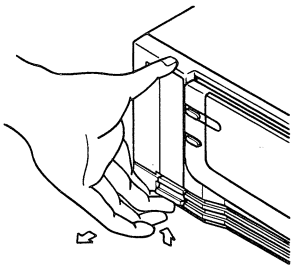


Fig. 1

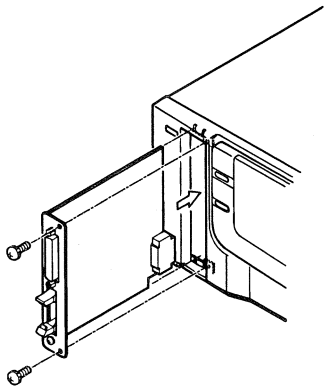


Fig. 2

2.4 Connecting the Interface Cable

CAUTION

- Before connecting the interface cable, always turn OFF the POWER switches of the PCR-W AC Power Supply and the computer that controls the IB11/RS11.

Match the orientation of the interface cable plug to that of the IB11/RS11 interface board connector.

2.5 Moving Precautions

CAUTION

- Moving a PCR-W AC Power Supply with the interface cable connected to the IB11/RS11 may place unreasonable stress on the cable. Before moving the PCR-W AC Power Supply, always disconnect the cable from the device.
- When moving the PCR-W AC Power Supply, follow the instructions given in the PCR-W AC Power Supply Operation Manual due to its heavy weight.

Chapter 3
INITIAL SETTING

Use of the IB11/RS11 requires initial setting of the PCR-W AC Power Supply control panel.
This chapter describes how to accomplish the initial setting.

Contents

3.1 GPIB Interface Board (IB11)

Before of the GPIB Interface board (IB11) 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 at factory shipment

GPIB address: 1

Response message terminator: CRLF + EOI

CAUTION Because switching the output phase mode (between single-phase and three-phase) turns the interface board into the setting at factory shipment, the GPIB address is set to "1".

3.1.1 Setting the GPIB Address

This subsection describes how to set the IB11 GPIB address.

GPIB Address Setting Procedure

· Set the GPIB address with the IB11 installed in a PCR-W AC Power Supply.

[Description] Shift key operation

In this manual, key operations that require pressing of the SHIFT key are denoted as follows:

Example: 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 (O 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-W AC Power Supply POWER switch again.

3.1.2 Response Message Terminator (Delimiter) Setting

The response message terminator (delimiter) is sent by the IB11 at the end of a response message to inform the GPIB controller that the response message is finished.

Response Message Terminator Setting Procedurer

▶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 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-W AC Power Supply POWER switch again. The response message terminator is also described in [TERM] in subsection 5.9.1, Response Message Terminator Setting ([TERM]).

[Description] Command message terminator

Setting of the command message terminator, which is a command termination symbol that the IB11 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)

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 RS-232C communication parameters of the RS11.

RS-232C Communication Parameter Setting Procedure

- Set the RS-232C communication parameters with the RS11 installed in a PCR-W AC Power Supply.

[Description] Shift key operation

In this manual, key operations that require pressing of the SHIFT key are denoted as follows:

Example: SHIFT + F (GP-IB)

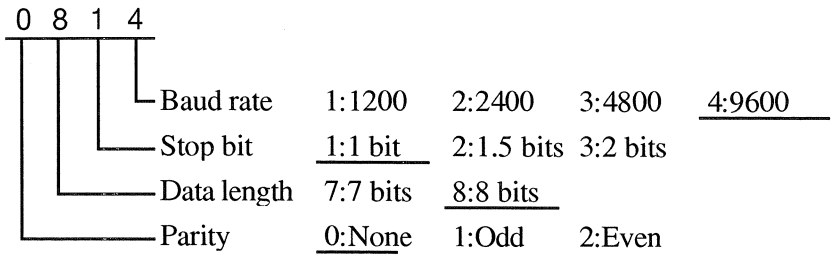
Indicates that you should press SHIFT (which lights the SHIFT indication on the control panel) and then F. (This selects the GPIB function.)

▶ Step 1 Press ESC to call the Home Position.

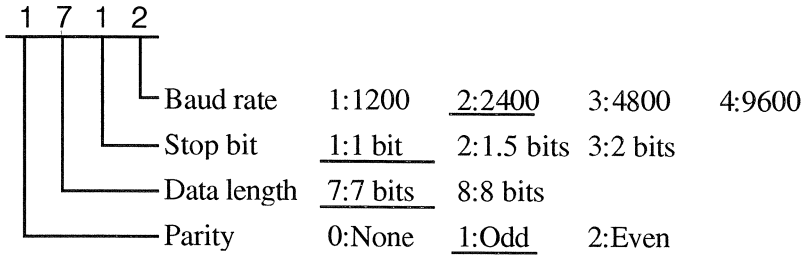
▶ Step 2 Press SHIFT + F (GP-IB).

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-W AC Power Supply POWER switch again.

3.2.2 Response Message Terminator (Delimiter) Setting

The response message terminator (delimiter) is sent by the RS11 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

CR: Carriage Return
LF: Line Feed

The response message terminator cannot be set from the PCR-W AC Power Supply control panel. Setting of the response message terminator requires the [TERM] command.
For the [TERM] command, see [TERM] in section 5.9.1, Response Message Terminator Setting ([TERM]).

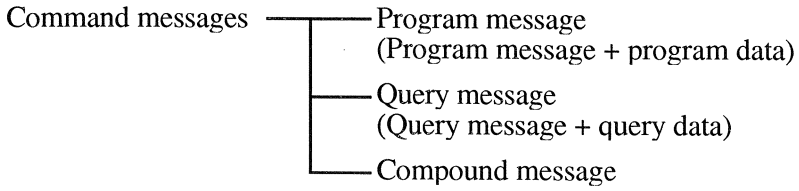
Chapter 4
BASIC KNOWLEDGE

Explains the terms used in this Operation Manual.

Contents

4.1 Command Messages

A command (ASCII code character string) sent from the GPIB controller or RS-232C terminal to the IB11/RS11 is called a "command message." Command messages include the following three types.



- Either uppercase or lowercase letters can be used.

4.1.1 Program Messages

Program messages are various commands used to operate the IB11/RS11. 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.

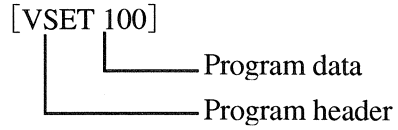
[Program header] [SP] [Program data] (, [Program data] ....)

Program message commands (from the controller to the IB11/RS11) 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 IB11/RS11 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, us ([s] for default)

4.1.2 Query Messages

A query message is a command used to obtain return information from the IB11/RS11 relating to the internal operation of the PCR-W 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 IB11/RS11 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 IB11/RS11) 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

[VSET?]
└——— Query header (with no query data)

Response to the [VSET?] command (from the IB11/RS11 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 IB11/RS11) 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 IB11/RS11 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 IB11/RS11 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 IB11/RS11 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 IB11 to GPIB controller)
For a voltage set value of 100 V····· [VSET 100.0V]
Response data
Response header

4.3 Acknowledgement Messages (RS-232C)

An acknowledgement message is information (ASCII code character string) sent by the RS11 to inform the RS-232C terminal of completion of program message processing. The acknowledgement message consists of only a header.

[Description] Acknowledgement messages

- Acknowledgement messages are specific to the RS-232C Interface board (RS11) 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 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 to the RS-232C terminal
  Accomplish suspension within ten characters after DC3 has been received.
- Control of sending from the RS-232C terminal to the RS11
  Suspension should be accomplished within three characters after DC3 has been received.

[Description] Send and receive control

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 MESSAGES DESCRIPTION

Describes the function and format of a variety of commands.

Contents

5.1 Before using the Interface Functions

Before using the interface functions, make sure the conditions specified below are met. An incorrect setting or improper connection may result in unexpected problems that take up a great deal of time.

■For GPIB

- Setting the address
  Correctly set the address of the IB11 and the address of the controller (computer). When performing this setting, make sure there is no equipment of the same address on the bus.
- Setting the computer environment
  Perform this setting carefully so that no collision is caused between the GPIB board side interrupt level or the DMA channel and another equipment.

■For RS-232C

- Setting the communication parameter
  Perform this setting so that the communication parameter of the RS11 (protocol of transfer speed) coincides with the communication parameter of the computer.
- Selection of cable
  The RS11 is prepared for DTE connection. Use a cross cable for connection to an ordinary computer. Check the connector on the computer and select the correct cable

5.2 Basic Command Messages

Refer to "Appendix 2: Sample Programs 1 and 2", which describes programs using command messages discussed in this paragraph.

5.2.1 Reading Model Information ([IDN?])

Use the [IDN?] command to determine the PCR-W 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
PCR-W Series	
PCR2000W	IDN PCR2000W VERX.XX KIKUSUI
PCR4000W	IDN PCR4000W VERX.XX KIKUSUI
PCR8000W	IDN PCR8000W VERX.XX KIKUSUI
PCR12000W	IDN PCR12000W VERX.XX KIKUSUI
PCR-W^2 Series single-phase mode	
PCR6000W^2	IDN PCR6000W2 1P VERX.XX KIKUSUI
PCR12000W^2	IDN PCR12000W2 1P VERX.XX KIKUSUI
PCR-W^2 Series three-phase mode	
PCR6000W^2	IDN PCR6000W2 VERX.XX KIKUSUI
PCR12000W^2	IDN PCR12000W2 VERX.XX KIKUSUI

5.2.2 Reading 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 IB11/RS11 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.

5.2.3 Error Clear ([CLR])

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

5.2.4 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 IB11 to GPIB controller)
When response header is assigned. . . . . [ACVSET 100.0V]
When response header is not assigned. . . . . [100.0]

5.3 Basic Command Messages as a AC Power Supply (AC mode)

Refer to "Appendix 2: Sample Programs 3 and 4", which describes programs using command messages discussed in this paragraph.

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	(Setting at POWER ON)
[OUT 1] [OUT ON]	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 AC Voltage Setting ([ACVSET])

AC voltage can be set using the [ACVSET] command.
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 IB11/RS11 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 [ACVSET?] command to read the AC voltage set value.

Examples: To set AC voltage to 100 V: [ACVSET 100]

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

[Description] [VSET] command

The [VSET] command with the same function as that of the [ACVSET] is effective in maintaining interchangeability with other AC power supplies manufactured by us.

5.3.3 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 IB11/RS11 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] ≦500.0 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 400Hz]

5.3.4 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]	100V range
[RANGE 0] [RANGE 200]	200V 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) .

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

The IB11/RS11 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-W 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 phase has been set or output OFF phase has been set except for 0 degree (FREE or 1 to 360°), the control panel S-MODE display area displays "4."

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]

5.3.6 Output Voltage Measurement ([VMRMS], [VMPK], [VM?], [VOUT?])

The IB11/RS11 has two output voltage measurement modes:
- Rms value measurement
- Peak value measurement

To measure voltage, set the desired measurement mode in advance. (For information about each measurement method, see the PCR-W AC Power Supply Operation Manual.) The table below shows the relationship between the output voltage measurement commands and output voltage measurement modes.

Output voltage measurement command	Output voltage measurement mode	
[VMRMS]	rms value measurement	(Setting at factory shipment)
[VMPK]	Peak value measurement	

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]

Use the [VOUT?] command to read the measured voltage. On receiving the [VOUT?] command, the IB11/RS11 returns as response data the measured-value obtained immediately before. The IB11/RS11 voltage measurement cycle varies with output frequency (approximately 0.3 second to 1.5 seconds) . 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 100.0V] (for 100 V output voltage)

- The [VMRMS], [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"the measured value is updated inside the IB11/RS11.

The IB11/RS11 takes approximately 0.3 second to 1.5 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.

5.3.7 Output Current Measurement ([IMRMS], [IMPK], [IMPKH], [PEAKINIT], [IM?], [IOUT?])

The IB11/RS11 has three output current measurement modes:
- Rms value measurement
- Peak value measurement
- Peak holding value measurement

To measure current, set the desired measurement mode in advance. (For any measurement method other than peak holding current measurement, see the PCR-W 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
[IMPK]	Peak value measurement
[IMPKH]	Peak holding value measurement

(Setting at factory shipment)

Peak Holding Current Measurement

The peak holding current measurement of the IB11/RS11 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.
- [PEAKINIT] command from the IB11/RS11
- Peak clear operation on the Remote Controller

[Description] [PEAKINIT] command

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.

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]

Use the [IOUT?] command to read the current measured-value. On receiving the [IOUT?] command, the IB11/RS11 returns as response data the measured-value obtained immediately before.
The IB11/RS11 current measurement cycle varies with output frequency (approximately 0.3 second to 1.5 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 10.0A] (for 10 A output current)

- The [IMRMS], [IMPK], [IMPKH], and [PEAKINIT] commands have no program data.

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

The IB11/RS11 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-W AC Power Supply. (For information about power measurement, see the PCR-W 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.

5.4 Limit Value Setting Command Messages for a AC Power Supply (AC mode)

Refer to "Appendix 2: Sample Program 5", which describes programs using command messages discussed in this paragraph.

5.4.1 Voltage Limit Setting ([ACVLO], [ACVHI])

The [ACVLO] and [ACVHI] commands are used to set the voltage limit value. (For information on the voltage limits, see the PCR-W AC Power Supply Operation Manual.)

	Program message	Setting at factory shipment
AC voltage low limit	[ACVLO]	0.0V
AC voltage high limit	[ACVHI]	305.0V

Use the [ACVLO?] or [ACVHI?] command to read the AC voltage limit set values.

5.4.2 Current Limit Setting ([ACILIM])

The [ACILIM] command is used to set the current limit value. (For information on the current limit, see the PCR-W AC Power Supply Operation Manual.)

	Program message	Setting at factory shipment
AC current high limit	[ACILIM]	1.1 times the rating

Use the [ACILIM?] to read the AC current limit set value.

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

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

	Program message	Setting at factory shipment
Frequency low limit	[FLO]	1.00Hz
Frequency high limit	[FHI]	500.0Hz

Use the [FLO?] or [FHI?] command to read the frequency limit set values.

5.5 Reading the Register and Setting Command Messages

Refer to "Appendix 2: Sample Programs 6 and 7", which describes programs using command messages discussed in this paragraph.

Internal registers

The IB11/RS11 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 IB11/RS11 status.
Unmask register	: Selects the cause of generation of SRQ (Service ReQuest) .
Mode register	: Indicates the operating status of the IB11/RS11.
Status register	: Indicates the status that changes with a cause (other than operation or control of the IB11/RS11) .
Fault register	: Indicates the fault status that changes with a cause (other than operation or control of the IB11/RS11) . This register also causes the status byte register content to change.
Fault unmask register	: Selects whether the fault register content is changed.

- 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.

5.5.1 Reading the Status Byte Register ([STB?])

The status byte register indicates the operating status of the IB11/RS11. 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
	RQS			ERR		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 [ ] : "0"
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"

5.5.2 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			FAU

Bit 0 [FAU] : Permits generation of a service request if any of the fault register bits is "1".
Bit 1 [ ] : "0"
Bit 2 [ ] : "0"
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"

5.5.3 Reading the Mode Register ([MOD?])

The mode register indicates the setting status of the IB11/RS11. 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
	PHA				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 [ ] : "0"
Bit 5 [ ] : "0"
Bit 6 [PHA] : Indicates that output ON/OFF phase has been set.
Bit 7 [ ] : "0"

5.5.4 Reading the Status Register ([STS?])

The status register indicates the status that changes from a cause other than operation or control of the IB11/RS11. 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		DAV		

Bit 0 [ ] : "0"
Bit 1 [ ] : "0"
Bit 2 [DAV] : Indicates that the measured value has been updated.
Bit 3 [ ] : "0"
Bit 4 [HER] : Indicates that a PCR-W 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.

5.5.5 Reading the Fault Register ([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 5.5.6) .
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		DAV		

Bit 0 [ ] : "0"
Bit 1 [ ] : "0"
Bit 2 [DAV] : Indicates that the measured value has been updated.
Bit 3 [ ] : "0"
Bit 4 [HER] : Indicates that a PCR-W 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.

5.5.6 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		DAV		

Bit 0 [ ] : "0"
Bit 1 [ ] : "0"
Bit 2 [DAV] : Permits whether the bit changes when a measured value is updated.
Bit 3 [ ] : "0"
Bit 4 [HER] : Permits whether the bit changes when a PCR-W AC Power Supply hardware error has 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 occurr.

5.6 Initializing Command Message and Reading Command Messages of Alarm Information

Refer to "Appendix 2: Sample Programs 8 and 9", which describes programs using command messages discussed in this paragraph.

5.6.1 Initializing Set Values ([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.
Note that the process time of the [SETINI] is approx. three seconds.

- Values stored in the memory
- Alarm status (to clear this, use the [ALMCLR] command)

[Description] Hold-off (GPIB)

The IB11/RS11 has a command input buffer function to improve the transfer speed of communication. Therefore, in the event that a program message requires a long time for processing, command processing may be incomplete even after the transfer has been completed.

To synchronize the program message and the command processing, the IB11/RS11 is provided with a hold-off function, which manages the GPIB bus hand shake until the end of processing. The hold-off function can be prepared with '@' (40H) attached to the end of the program message. However, in the event of a command message terminator with only EOI (End or Identify), use '@@'.

Example: CALL ibwrt (bd,"SETINI@@")
CALL ibwrt (bd,"out 1@@")

5.6.2 Reading Alarm Information ([SELFTEST?])

Use the [SELFTEST?] command to determine the cause and location of an alarm that has occurred in the PCR-W 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 [SLFTEST?] 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-W AC Power Supply Operation Manual.

5.6.3 Clearing Alarm Information ([ALMCLR])

Use the [ALMCLR] command to clear an alarm. The [ALMCLR] command has no program data. (For details, see the PCR-W AC Power Supply Operation Manual.)
In the event of an alarm, commands other than [ALMCLR] and [SELFTEST] may not operate normally.

5.7 Command Messages for DC/AC+DC Mode

Refer to "Appendix 2: Sample Program 10", which describes programs using command messages discussed in this paragraph.

The PCR-W AC Power Supply has AC, DC, and AC + DC output modes. Output voltage setting is accomplished for AC and DC voltages individually.

5.7.1 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-W 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) .
- No panel operation on the PCR-W AC Power Supply is possible if local status (panel operation on PCR-W AC Power Supply) is selected, maintaining the AC + DC mode. Using the [ACDC] command, select the AC or DC mode, or turn OFF the power to the PCR-W AC Power Supply and then turn it on.

5.7.2 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 IB11/RS11 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]

5.7.3 Average Output Voltage Measurement ([VMAVE], [VOUT?])

The [VMAVE] command is used to set an average voltage measurement effective for the DC/AC + DC mode. Measured voltage values can be read out using the [VOUT?] command.
Other output-voltage measurement commands-[VMRMS], [VMPK], and [VM?]-that are set in the AC mode can also be used in the DC/AC + DC mode. Concerning the commands [VMRMS], [VMPK], and [VM?], see 5.3.6.

・ The [VMAVE] command has no program data.

5.7.4 Average Output Current Measurement ([IMAVE], [IOUT?])

The [IMAVE] command is used to set an average current measurement effective for the DC/AC + DC mode. Measured current values can be read out using the [IOUT?] command.
Other output-current measurement commands-[IMRMS], [IMPK], [IMPKH], and [IM?]-that are set in the AC mode can also be used in the DC/AC + DC mode. Concerning the commands [IMRMS], [IMPK], [IMPKH], and [IM?], see 5.3.7.

・ The [IMAVE] command has no program data.

5.7.5 DC Voltage Limit Value Setting ([DCVLO], [DCVHI])

The [DCVLO] and [DCVHI] commands are used to set voltage limit value. (For information on the voltage limits, see the PCR-W AC Power Supply Operation Manual.)

	Program message	Setting at factory shipment
DC voltage low limit	[DCVLO]	-431.0V
DC voltage high limit	[DCVHI]	431.0V

Use the [DCVLO?] or [DCVHI?] command to read the DC voltage limit set values.

5.7.6 DC Current Limit Value Setting ([DCILIM])

The [DCILIM] command is used to set the current limit value. (For information on the current limits, see the PCR-W AC Power Supply Operation Manual.)

	Program message	Setting at factory shipment
DC current high limit	[DCILIM]	1.1 times the rating

Use the [DCILIM?] command to read the DC current limit set value.

5.8 Memory Setting Command Messages

Refer to "Appendix 2: Sample Program 11", which describes programs using command messages discussed in this paragraph.

The PCR-W 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 IB11/RS11. This data can be read for output as necessary.
When IB11/RS11 is installed, the number of set values that can be written in the memory (the number of memory addresses) increases to 99. The IB11/RS11 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-W AC Power Supply or RC02-PCR-L Remote Controller. (Running of memory data cannot be achieved via the interface board.)

5.8.1 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, DCV]

- DCV — DC voltage
- FREQ — Frequency
- ACV — AC voltage
- ADRS — Memory address

Examples: To store 100 V AC, 50 Hz, and 0 V DC to address 5
MEMSTO 5, 100, 50, 0

To store 2 V AC, 3 Hz, and 5 V DC to address 1
MEMSTO 1, 2, 3, -5

To read memory data using the [MEMSTO?] command
[MEMSTO] [SP] [ADRS?]

- ADRS? — Memory address

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

5.8.2 AC Voltage and Frequency Memory 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 5,110.0V

5.8.3 Memory Content Erasure ([CLRMEMORY])

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

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

5.9 Other Command Messages

5.9.1 Response Message Terminator (Delimiter) Setting ([TERM])

The IB11/RS11 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 IB11/RS11 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.

5.9.2 RS-232C Acknowledgement Message Control ([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
[SILENT 0] [SILENT OFF]	Assigned

(Setting at POWER ON)

5.9.3 IB01-PCR Command Support ([IB01PCR])

The [IB01PCR] command allows the commands of the IB01-PCR (conventional PCR series GPIB option) to be used on the IB11/RS11. 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 IB11/RS11.
- The configuration of the various registers becomes the same as that of the IB01-PCR.
- The commands available on the IB11/RS11 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] [IB01PCR] command

- 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-W 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 IB11.
- When using a program for the IB01-PCR on the IB11, it is recommended that the program be modified for the IB11 rather than being used "as is" with the [IB01PCR] command. (For the program modification method, refer to "Appendix 3: Guidance for Changing IB01-PCR Programs for Use on IB11".)

5.9.4 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
[BACKUP 0] [BACKUP OFF]	Not updated

(Setting at POWER ON)

- Setting values are backed up by the EEPROM in the PCR-W AC Power Supply. However, there is a limitation on the number of EEPROM update operations. (See Section 10.3, [Description], in the PCR-W 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-W AC Power Supply POWER switch again or setting on the update operation.

Chapter 6
USING A PCR-W^2 IN THREE PHASE MODE

Describes the functions available in the three-phase mode of the PCR-W^2 AC Power Supplies that are different from those available in the single-phase mode.

Contents

This chapter only describes the use of the PCR-W² AC Power Supplies in the three-phase mode. If using the PCR-W AC Power Supplies, skip this chapter.
If the PCR-W² AC Power Supplies and the IB11/RS11 are used in combination in the three-phase mode, the functions described below are different from those available in the single-phase mode.

6.1 Limited Functions

The following mode cannot be used:

- DC and AC + DC modes

6.2 Line Voltage/Phase Voltage Display ([VLINE], [VPHASE])

The phase voltage display [VPHASE] command and line voltage display [VLINE] command can be selected in order to display the measured voltage value. These commands require no program data. When the POWER switch is turned ON, the equipment is in phase voltage display.

- When any data other than the initial settings are applied to the U-to-V phase or U-to-W phase, no line voltages can be set.
- Line voltages can be set only in line voltage display mode.
- Power, volt-ampere, and power-factor measurements are available only in phase voltage display mode.

6.3 Output Voltage Setting ([ACVSET], [LINEVSET])

There are two types of output voltage setting commands; one is for phase voltage setting ([ACVSET] command) and the other is for line voltage setting ([LINEVSET] command).

- Setting the output voltage applies the same value to the voltages of all phases.
- The [LINEVSET] command is available only in line voltage display mode.
- The range of the program data in the [VSET] and [ACVSET] commands is the same as that in single-phase operation. The [LINEVSET] command allows the setting of a voltage level 1.73 times the program data of the [VSET] command.
- The [VSET] and [ACVSET] commands perform the same operation.

[Description] [VSET] command

The [VSET] command with the same function as that of the [ACVSET] is effective in maintaining interchangeability with other AC power supplies manufactured by us.

6.4 Setting Each Phase Voltage ([UVSET], [VVSET], [WVSET])

U-phase voltage setting ([UVSET] command), V-phase voltage setting ([VVSET] command), and W-phase voltage setting ([WVSET] command) are available to individually set phase voltage.

- The [UVSET], [VVSET], and [WVSET] commands are available only in phase voltage display mode.
- The range of the program data in those commands is the same as that in the [ACVSET] command.

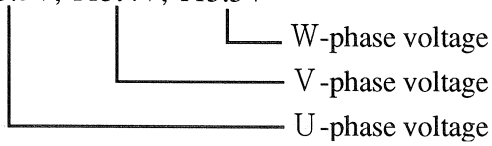
6.5 Voltage and Current Measurements ([VOUT?], [IOUT?])

The [VOUT?] and [IOUT?] commands, available in single-phase operation, can be used to read measured voltage or current values.

- The response data of [VOUT?] command shows the U-, V-, and W-phase voltages, separated by commas, in phase voltage display mode or the U-to-V, V-to-W, and W-to-U phase voltages, also separated by commas, in line voltage display mode.

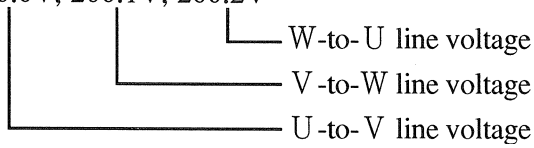
Examples: The response message of [VOUT?] command in the phase voltage display mode

VOUT 115.3V, 115.4V, 115.5V



The response message of [VOUT?] command in the line voltage display mode

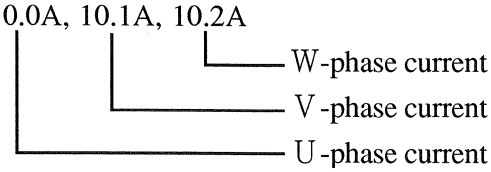
VOUT 200.0V, 200.1V, 200.2V



- The response data of [IOUT?] command shows U-, V-, and W-phase currents separated by commas.

Example: The response message of [IOUT?] command

IOUT, 10.0A, 10.1A, 10.2A



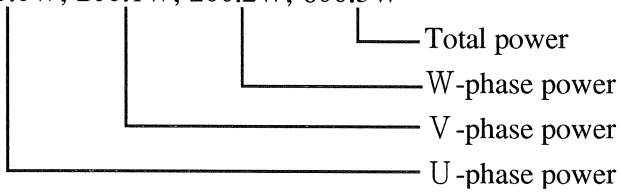
6.6 Power, Power-Factor, and Volt-ampere Measurements ([WATT?], [PF?], [VA?])

The [WATT?], [PF?], and [VA?] commands, available in single-phase operation, can be used to read power, power-factor, and volt-ampere measured values.

- These commands are available only in phase voltage display mode.
- The response data shows U-phase, V-phase, W-phase, and total data which are separated by commas.

Example: The response message of [WATT?] command

WATT 200.0W, 200.1W, 200.2W, 600.3W



6.7 Setting the U-to-V or U-to-W Phase Difference ([PHASEV], [PHASEW])

The [PHASEV] command is used to set the U-to-V phase difference; the [PHASEW] command is used to set the U-to-W phase difference. The [PHASEV?] and [PHASEW?] commands are used to read the U-to-V or U-to-W phase difference.
Integers values from 0 to 360 can be set for the [PHASEV] and [PHASEW] commands and their defaults at factory shipment are as follows:

Header	Default
[PHASEV]	120
[PHASEW]	240

- The [PHASEV] and [PHASEW] commands are available only in phase voltage display mode.
- If any data other than the defaults is set to U-to-V or U-to-W phase, the line voltage display mode cannot be selected.

Example:
PHASEV 125 Sets U-to-V phase difference to 125 degree.
PHASEW 238 Sets U-to-W phase difference to 238 degree.

6.8 Memory Setting Command ([MEMSTO])

DC voltage data (DCV) must always be set to 0 V.
No DC voltage data is output even if it is set.

Chapter 7
SPECIFICATIONS

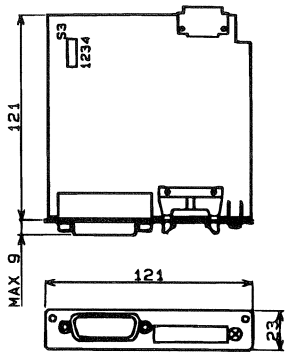
Lists the specifications of this equipment.

Contents

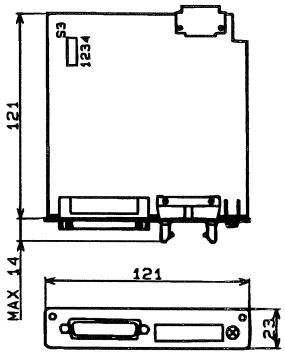
7.1 Specifications

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	—
Output ON/OFF phase setting		0 degree to 360 degree	1 degree	1 degree
Indicator				
	Voltampere measurement	—	0. 01 VA min. (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 rdg + 16 d) (from 5% of max. rated current to max. rated peak current at normal temperature)

7.2 Dimensions



IB11



RS11

Unit: mm

APPENDIX

Contains the quick command reference sheets and sample programs.

Contents

Appendix 1 Quick Command Reference

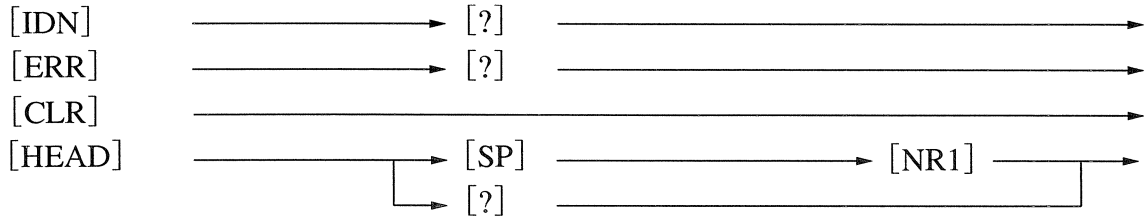
1. Data type

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)

2. Basic Command Messages

Header	Data type	Description	Setting range
IDN?	string	Returns a model number.	
ERR?	NR2	Returns an error code.	
CLR		Clears error register bits.	
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.	

Command formats

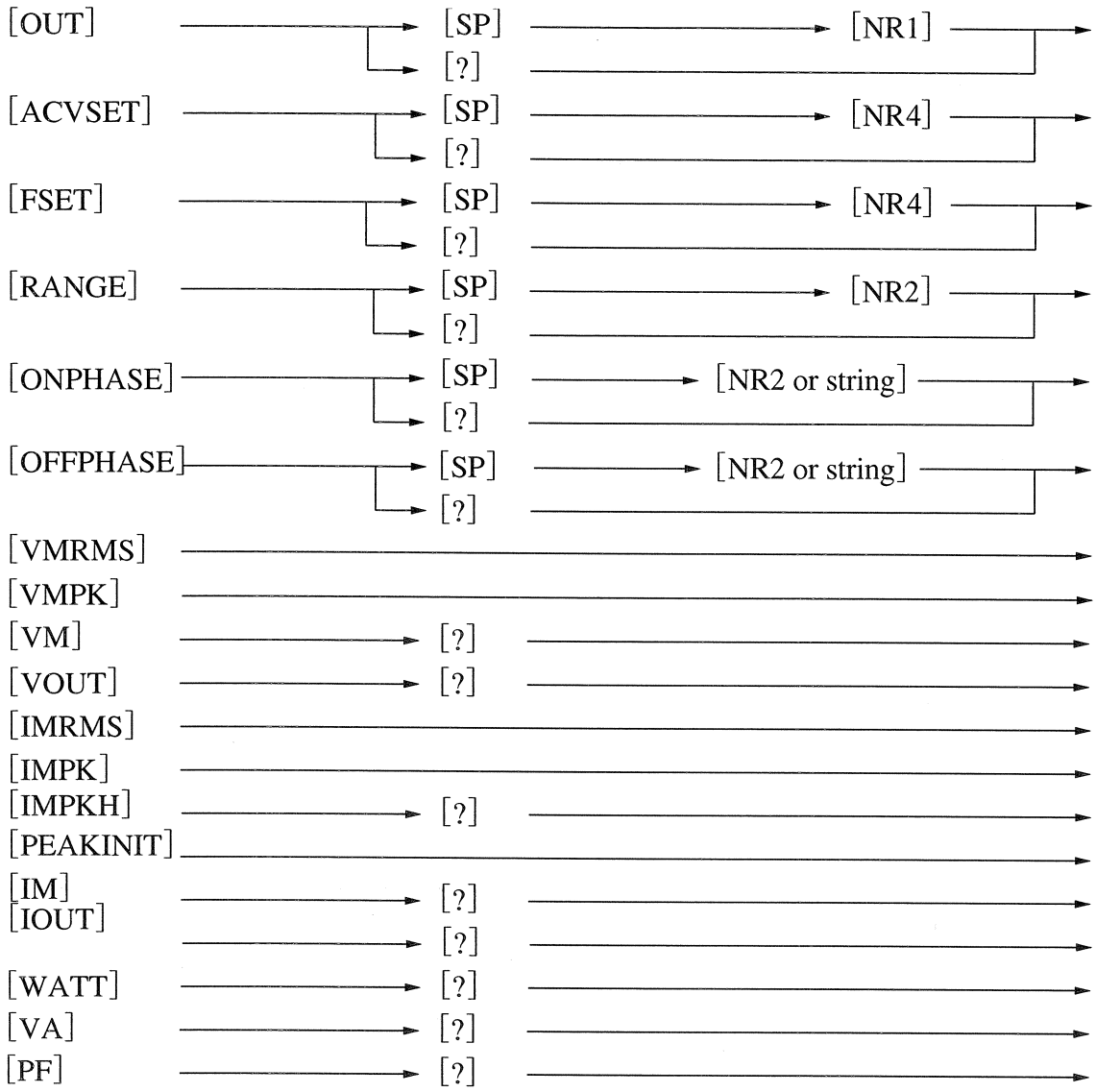


3. Basic Command Message as a AC Power Supply (AC mode)

Header	Data type	Description	Setting range
OUT	NR1	Controls output ON/OFF.	
OUT?	NR1	Returns output status.	
ACVSET	NR4	Sets AC output voltage. *	0 to 152.5 [V]/0 to 305.0 [V] (Output100 V/200 V range) Resolution: 0.1 [V]
ACVSET?	NR4	Returns an AC output voltage set-value.	
FSET	NR4	Sets frequency.	1.00 to 500.0 [Hz] Resolution: 0.01 [Hz]/0.1 [Hz]
FSET?	NR4	Returns a frequency set-value.	
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.	
ONPHASE	NR2 string	Sets output ON phase. FREE: Cancels output ON phase.	0 to 360 [degree] Resolution: 1 [degree]
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 [degree] Resolution: 1 [degree]
OFFPHASE?	NR2 string	Returns output OFF phase setting data. FREE: No output OFF phase has been set.	
VMRMS		Sets output voltage measurement mode to rms value.	
VMPK		Sets output voltage measurement mode to peak value.	
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.	
PEAKINIT		Clears the peak holding value.	
IM?	string	Returns output current measurement mode data.	
IOUT?	NR4	Returns the measured output current 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.	

* Sets phase voltage when the PCR-W^2 Series is used in three-phase mode.

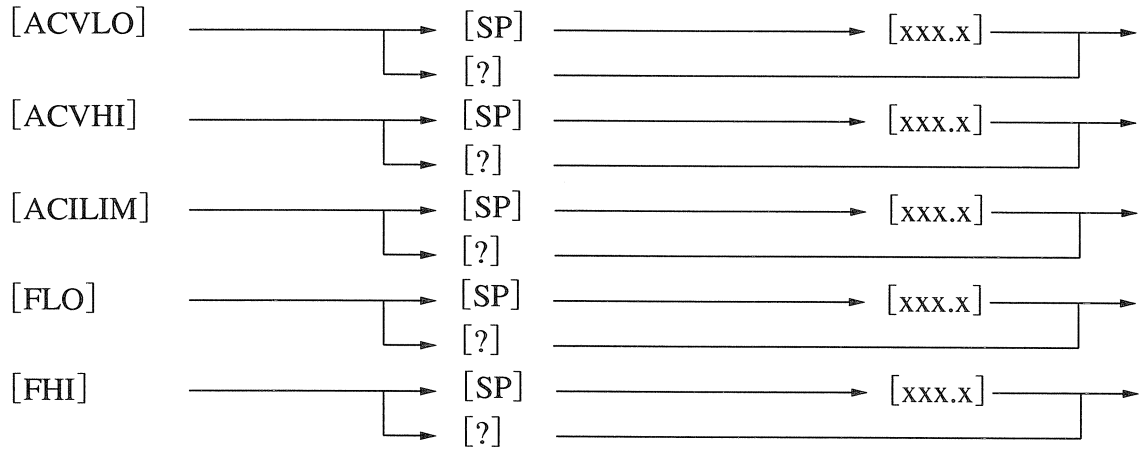
Command formats



4. Limit Value Setting Command Messages for a AC Power Supply (AC mode)

Header	Data type	Description	Setting range
ACVLO	NR4	Sets AC output voltage low limit.	0 to 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 to 305.0 [V] Resolution: 0.1 [V]
ACVHI?	NR4	Returns the AC output voltage high limit.	
ACILIM	NR4	Sets the AC output current limits.	10% to 110% of the maximum rated current (AC) (The values change with the output voltage or frequency.)
ACILIM?	NR4	Returns the AC output current limits.	
FLO	NR4	Sets the output frequency low limit.	1.00 to 500.0 [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 to 500.0[Hz] Resolution: 0.01／0.1 [Hz]
FHI?	NR4	Returns the output frequency high limit.	

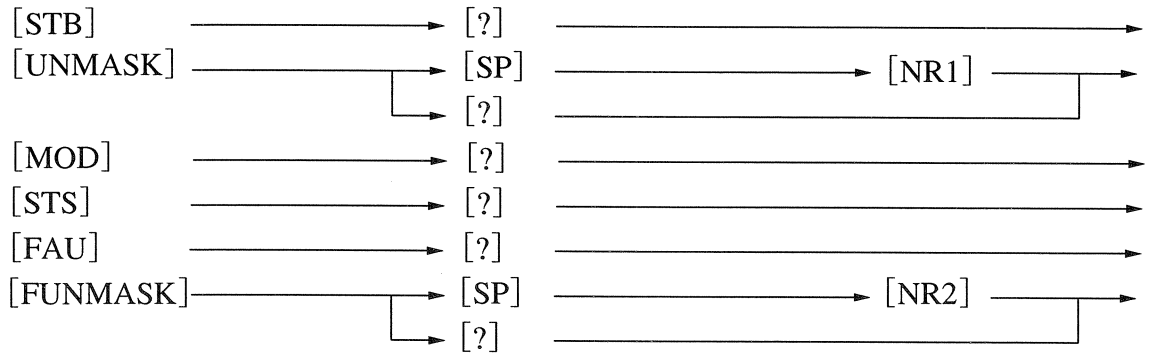
Command formats



5. Reading the Register and Setting Command Messages

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.	
MOD?	NR2	Returns mode register data.	
STS?	NR2	Returns status register data.	
FAU?	NR2	Returns fault register data.	
FUNMASK	NR2	Sets fault unmask register data.	
FUNMASK?	NR2	Returns fault unmask register data.	

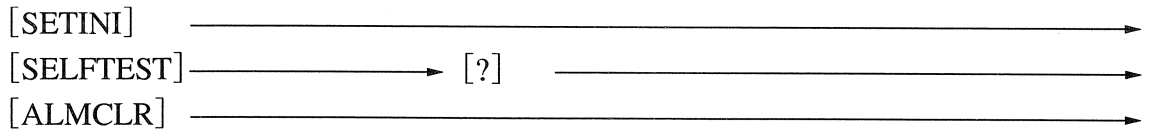
Command formats



6. Initializing Command Message and Reading Command Messages of Alarm Information

Header	Data type	Description	Setting range
SETINI		Selects the initial set-up status.	
SELFTEST?	FORMAT	Returns the self-test result.	
ALMCLR		Clears alarm.	

Command formats



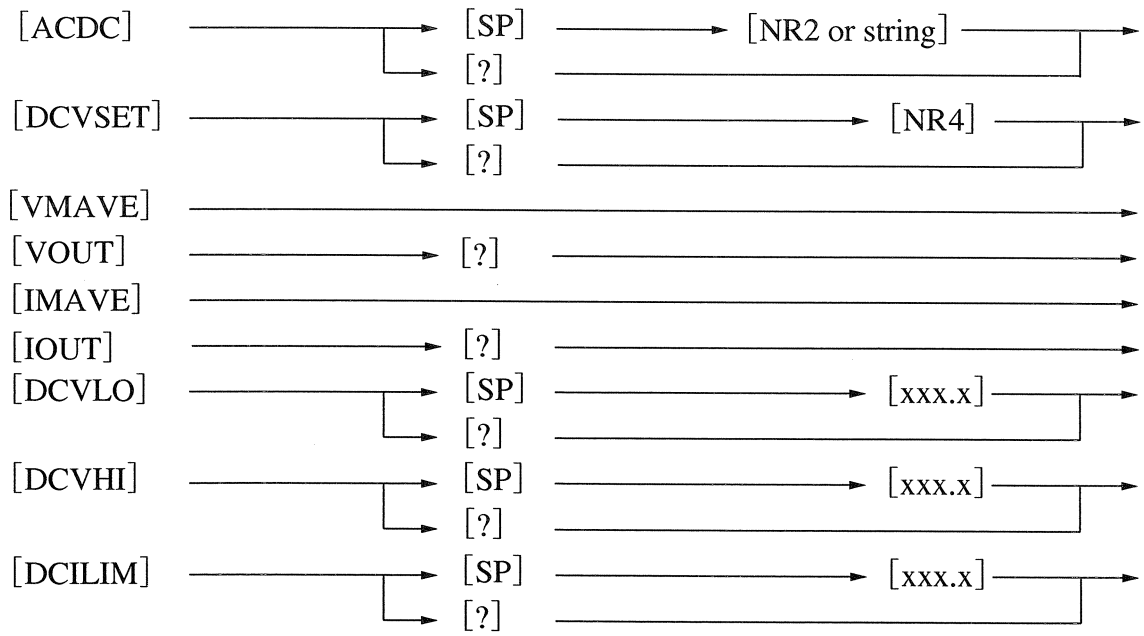
SELFTEST format data

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

7. Command Messages for DC/AC+DC Mode

Header	Data type	Description	Setting 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.	
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.	
VMAVE		Sets output voltage measurement mode to average value.	
VOUT?	NR4	Returns the measured output voltage value.	
IMAVE		Sets output current measurement mode to average value.	
IOUT?	NR4	Returns the measured output current value.	
DCVLO	NR4	Sets DC output voltage low limit.	-431.0 to +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 to +431.0 [V] Resolution: 0.1 [V]
DCVHI?	NR4	Returns the DC output voltage high limit.	
DCILIM	NR4	Sets the DC output current limits.	10% to 110% of the maximum rated current (DC) (The values change with the output voltage.)
DCILIM?	NR4	Returns the DC output current limits.	

Command formats



8. Memory Setting Command Messages

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 voltage setting range
FSTO?	NR2	Returns memory frequency data.	
CLRMEMORY		Erases all memory data.	

MEMSTO format data

Program message and response message

MEMSTO ××, ×××, ×××, ×××

- DC voltage (NR4)
- Frequency (NR4)
- AC voltage (NR4)
- Address (NR2)

Query message

MEMSTO ××?

- Address (NR2)

VSTO format data

VSTO ××?

- Address (NR2)

Response message

VSTO ××, ×××

- AC voltage (NR4)
- Address (NR2)

Query message

VSTO ××?

- Address (NR2)

FSTO format data

Program message

FSTO ××

Address (NR2)

Response message

FSTO ××, ×××

Frequency (NR4)

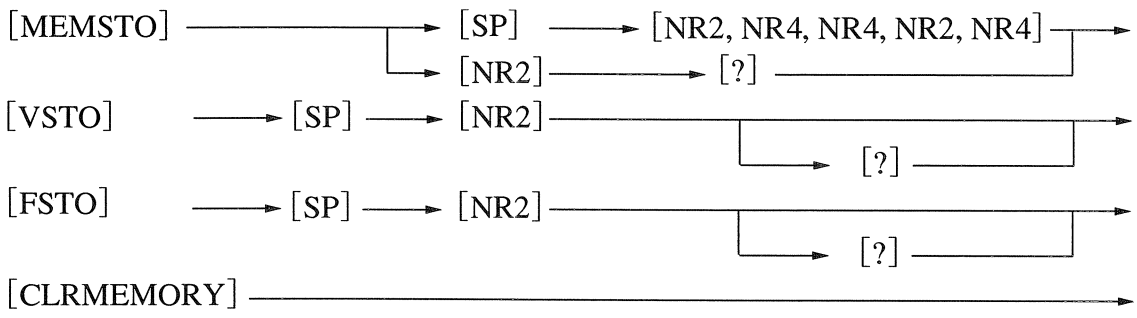
Address (NR2)

Query message

FSTO ××?

Address (NR2)

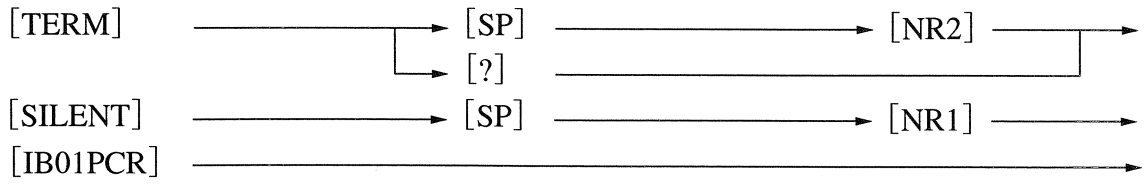
Command formats



9. Other Command Messages

Header	Data type	Description	Setting range
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.	
SILENT	NR1	Sets acknowledgment message ON/OFF.	
IB01PCR		Supports the IBOl-PCR commands.	

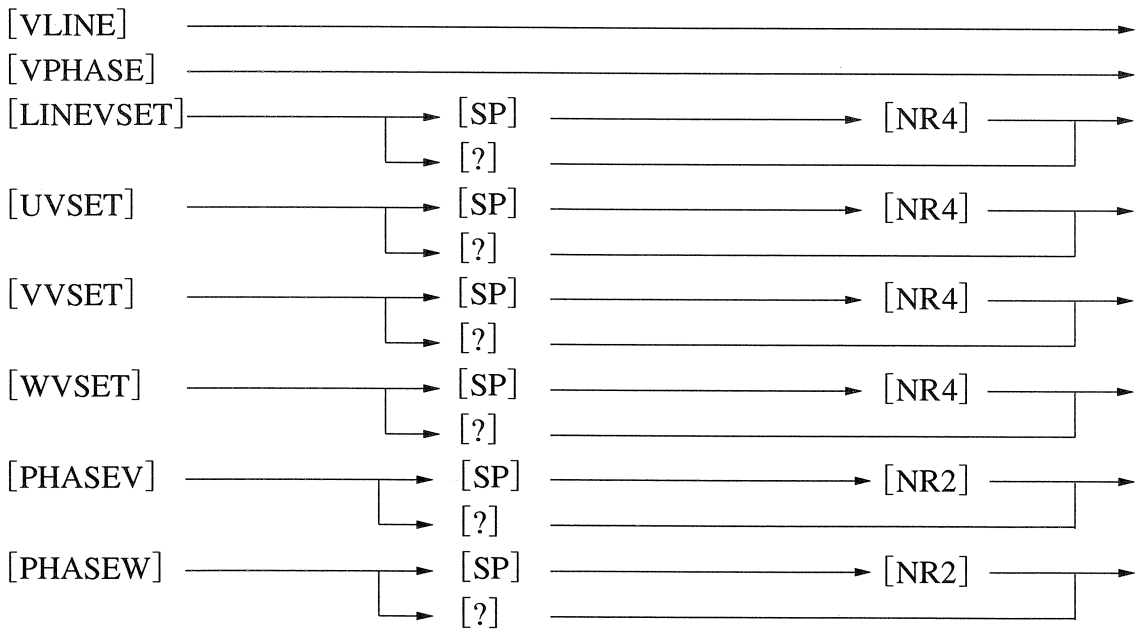
Command formats



10. Effective Command Messages for the PCR-W² AC Power Supplies used in the Three-Phase Mode

Header	Data type	Description	Setting range
VLINE		Sets voltage measurement display to line voltage display.	
VPHASE		Sets voltage measurement display to phase voltage display.	
LINEVSET	NR4	Sets line voltage.	Allows the setting of a voltage level 1.73 times the program data of the [VSET] command.
LINEVSET?	NR4	Returns a line voltage set-value.	
UVSET	NR4	Sets U-phase voltage.	The same as the program data of the [VSET] command.
UVSET?	NR4	Returns a U-phase voltage set-value.	
VVSET	NR4	Sets V-phase voltage.	The same as the program data of the [VSET] command.
VVSET?	NR4	Returns a V-phase voltage set-value.	
WVSET	NR4	Sets W-phase voltage.	The same as the program data of the [VSET] command.
WVSET?	NR4	Returns a W-phase voltage set-value.	
PHASEV	NR2	Sets U-to-V phase difference.	0 to 360 [degree] Resolution: 1 [degree]
PHASEV?	NR2	Returns a U-to-V phase difference set-value.	
PHASEW	NR2	Sets U-to-W phase difference.	0 to 360 [degree] Resolution: 1 [degree]
PHASEW?	NR2	Returns a U-to-W phase difference set-value.	

Command formats



Appendix 2 Sample Programs

Sample Program 1

This program, which uses GPIB, reads out the model information and command error information from the IB11, and displays it. As for GPIB error or command error, however, error-processing program is not included and only display of error information is conducted.

```
'<<Acquisition of model information and command error information>>
  '<Opening the GPIB device>
    Call ibfind("DEV1", bd)              'Open the device and obtain a unit descriptor.
    If ibsta < 0 Then                    'Check the GPIB error at ibfind.
        MsgBox "GPIB: ibfind error!"     'Output an error message
        Exit Sub                         'End without executing the following programs.
    End If                               'End the "error if" sentence

  '<Setting the response header>
    Call ibwrt(bd, "HEAD 0")             'Set the following response headers to no assignment.
    If ibsta < 0 Then
        MsgBox "GPIB: ibwrt error!"
        Exit Sub
    End If

  '<Acquiring model information>
    Call ibwrt(bd, "IDN?")               'Send a model-information acquisition command.
    If ibsta < 0 Then
        MsgBox "GPIB: ibwrt error!"
        Exit Sub
    End If
    Dim sModelName  As String            'Declare the parameter sModelName for readout
                                          character string.
    sModelName = Space(128)              'Secure a space of 128 bites for the parameter
                                          sModelName.
    Call ibrd(bd, sModelName)            'Read out the model information and store it into
                                          parameter.
    If ibsta < 0 Then
        MsgBox "GPIB: ibrd error!"
        Exit Sub
    End If
    MsgBox Left$(sModelName, ibcntl)     'Display the read-out model information.

  '<<Acquiring error information>>
    Call ibwrt(bd, "ERR?")               'Send the error-information acquisition command.
    If ibsta < 0 Then
        MsgBox "GPIB: ibwrt error!"
        Exit Sub
    End If
```

```
Dim sErrorRegister As String          'Declare the parameter sErrorRegister for readout
                                       character string.
sErrorRegister = Space(128)           'Secure a space of 128 bites for the parameter
                                       sErrorRegister.
Call ibrd(bd, sErrorRegister)         'Read out error the information and store it into
                                       parameter.
If ibsta < 0 Then
    MsgBox "GPIB: ibrd error!"
    Exit Sub
End If
Dim iErrorRegister As Integer         'Declare the integer parameter iErrorRegister for
                                       conversion.
iErrorRegister = Val(Left$(sErrorRegister, ibcntl)) 'Convert the error information from
                                                     character strings into values.
MsgBox "ERR Register = " & Str$(iErrorRegister)     'Display the read-out error information.

If iErrorRegister <> 0 Then           'Check the PCR-W error.
    MsgBox "PCR-W: An error occured!" '  Output an error message
    Exit Sub
End If
```

Sample Program 2

This program, which uses RS-232C, reads out the model information and command error information from the RS11, and displays it. As for RS-232C error or command error, however, error-processing program is not included and only display of error information is conducted.

```
'<<Acquisition of model information and command error information>>
  '<Parameter declaration for RS-232C device>
    Dim hFile As Integer              'File-handling parameter
    Dim rs As Integer                 'Value returned from device

  '<RS232C device opening COM1:>
    hFile = rsinit(1, 9600, NOPARITY, 8, ONESTOPBIT, False, 10000)
    If hFile < 0 Then                 'Check the RS-232C error.
        MsgBox "RS-232C: rsinit error!"   'Output an error message.
        Exit Sub                      'End without executing the following programs.
    End If                            'End the "error if" sentence

  '<Setting the response header>
    rs = rswrts(hFile, "HEAD 0")      'Set the following response headers to no assignment.
    If rs < 0 Then
        MsgBox "RS-232C: rswrts error!"
        Exit Sub
    End If

  '<Acquiring model information>
    rs = rswrts(hFile, "IDN?")        'Send the model-information acquisition command.
```

```
    If rs < 0 Then
        MsgBox "RS-232C: rswrts error!"
        Exit Sub
    End If
    Dim sModelName  As String              'Declare the parameter sModelName for read out
                                            character string.
    sModelName = Space(128)                'Secure a space of 128 bites for the parameter
                                            sModelName.
    rs = rsrds(hFile, sModelName, 128)     'Read out the model information and store it into
                                            parameter.
    If rs < 0 Then
        MsgBox "RS-232C: rsrds error!"
        Exit Sub
    End If
   MsgBox Left(sModelName, InStr(sModelName, Chr$(13)))  'Display the read-out model information.

  '<<Acquiring error information>>
    rs = rswrts(hFile, "ERR?")             'Send the error-information acquisition command.
    If rs < 0 Then
        MsgBox "RS-232C: rsrds error!"
        Exit Sub
    End If
    Dim sErrorRegister As String           'Declare the parameter sErrorRegister for readout
                                            character string.
    sErrorRegister = Space(128)            'Secure a space of 128 bites for the parameter
                                            sErrorRegister.
    rs = rsrds(hFile, sErrorRegister, 128) 'Read out the error information and store it into
                                            parameter.
    If rs < 0 Then
        MsgBox "RS-232C: rsrds error!"
        Exit Sub
    End If
    Dim iErrorRegister As Integer          'Declare the parameter iErrorRegister for read out
                                            character string.
    iErrorRegister = Val(sErrorRegister)   'Convert the error information from character
                                            strings into values.
    MsgBox "ERR Register = " & iErrorRegister
'Display the read-out error information.

    If iErrorRegister <> 0 Then            'Check the PCR-W error.
        MsgBox "PCR-W: An error occured!"  '  Output an error message.
    End If

  '<Closing the RS-232C device>
    rs = rsdone(hFile)
```

Sample Program 3

This program sets the PCR-W AC Power Supplies to 100 V; 50 Hz; output ON phase: 0 degrees; output OFF phase: random. The opening of GPIB devices and error processing are omitted.

```
'<<Setting voltage, frequency, and output phase>>
  '<Set the voltage to 100 V, the frequency to 50 Hz, the output ON phase to 0 degrees, the output
   OFF phase to random, and the output to ON>
    Call ibwrt(bd, "SETINI@@")          'For details on the SETINI command, see 5.6.1.
    Call ibwrt(bd, "RANGE 0")           'Set the output voltage range to 100 V.
    Call ibwrt(bd, "ACVSET 100.0")      'Set the AC output voltage to 100.0 V.
    Call ibwrt(bd, "FSET 50.00")        'Set the output frequency to 50.00 Hz.
    Call ibwrt(bd, "ONPHASE 0")         'Set the output phase to 0 degrees.
    Call ibwrt(bd, "OFFPHASE FREE")     'Set the output phase to random.
    Call ibwrt(bd, "OUT 1")             'Set the output to ON.
```

Sample Program 4

This program is used to read out measured values of voltage/current effective values, power, voltamperes, and power factor from the PCR-W AC Power Supplies.

```
'<<Acquiring measured values of voltage, current, and power, and displaying them>>
  '<Measuring the effective value of output voltage>
    Call ibwrt(bd, "VMRMS")             'Select the effective-value measurement mode for the
                                         output voltage measurement mode.
    '...Wait for measurement to be completed.....
    Call ibwrt(bd, "VOUT?")             'Send output voltage readout command.
    Dim sOutV As String
    sOutV = Space(128)
    Call ibrd(bd, sOutV)                'Read out the output voltage measurement data,
                                         and store it in sOutV.
    MsgBox "Vrms= " & Left$(sOutV, ibcntl) 'Display the measured data.

  '<Measuring the effective value of output current>
    Call ibwrt(bd, "IMRMS")             'Select the effective-value measurement mode for the
                                         output current measurement mode.
    '...Wait for measurement to be completed.....
    Call ibwrt(bd, "IOUT?")             'Send the output current readout command.
    Dim sOutI As String
    sOutI = Space(128)
    Call ibrd(bd, sOutI)                'Read out the output current measurement data,
                                         and store it in sOutI.
    MsgBox "Irms= " & Left$(sOutI, ibcntl) 'Display the measured value.

  '<Measuring the power, voltamperes, and power factor>
    Call ibwrt(bd, "WATT?")             'Send the power readout command.
    Dim sOutW As String
```

```
    sOutW = Space(128)
    Call ibrd(bd, sOutW)                    'Store the power measurement data in sOutW.
    MsgBox "Watt= " & Left$(sOutW, ibcntl) 'Display the measured value.

    Call ibwrt(bd, "VA?")                   'Send the voltampere readout command.
    Dim sOutVa As String
    sOutVa = Space(128)
    Call ibrd(bd, sOutVa)                   'Store the voltampere measurement data in sOutVa.
    MsgBox "VA = " & Left$(sOutVa, ibcntl) 'Display the measured value.

    Call ibwrt(bd, "PF?")                   'Send the power-factor readout command.
    Dim sOutPf As String
    sOutPf = Space(128)
    Call ibrd(bd, sOutPf)                   'Store the power-factor measurement data in sOutPf.
    MsgBox "PF = " & Left$(sOutPf, ibcntl) 'Display the measured value.
```

Sample Program 5

This program sets the PCR-W AC Power Supplies to the voltage limit 80 V/120 V, current limit 12 A, and frequency limit 45 Hz/65 Hz.

```
'<<Setting limit value>>
  '<Setting the AC output-voltage limit value>
    Call ibwrt(bd, "ACVLO 80")              'Set the AC output-voltage lower limit at 80 V.
    Call ibwrt(bd, "ACVHI 120")             'Set the AC output-voltage upper limit at 120 V.

  '<Setting the AC output-current limit value>
    Call ibwrt(bd, "ACILIM 12")             'Set the AC output-current upper limit at 12 A.

  '<Setting the output-frequency limit value>
    Call ibwrt(bd, "FLO 45")                'Set the output-frequency lower limit at 45 Hz.
    Call ibwrt(bd, "FHI 65")                'Set the output-frequency upper limit at 65 Hz.
```

Sample Program 6

Using the status-register DAV (measurement revision) bit, this program is used to measure rush current.

```
'<<Rush current measurement>>
  '<Parameter declaration>
    Dim sStsRegister As String              'Parameters for status register readout character
                                             strings
        sStsRegister = Space(128)
    Dim iStsRegister As Integer             'Integer parameters for status register
    Dim sOutputI As String                  'Parameters for current measurement data readout
                                             character strings
        sOutputI = Space(128)
```

```
    Dim dOutputI As Double                  'Current value real parameter
    Dim dPeakMaxI As Double                 'Max. peak current value real parameter

  '<Peak current measurement mode setting and initialization>
    Call ibwrt(bd, "OUT 0")                 'First, turn off the output.
    Call ibwrt(bd, "IMPKH")                 'Set to the peak-hold current measurement mode.
    Call ibwrt(bd, "PEAKINIT")              'Clear the peak current value.

  '<Waiting time for clearing the peak current>
    Dim iForCounter As Integer              'Counter parameter declaration
    For iForCounter = 1 To 2                'Awaiting two measurement cycles
        Do                                  'Measurement end observation
          Call ibwrt(bd, "STS?")            'Status register readout.
          Call ibrd(bd, sStsRegister)
          iStsRegister = Val(Left$(sStsRegister, ibcntl))
          DoEvents                          '(For DoEvents, see the reference of VisualBasic.)
        Loop Until iStsRegister And 4       'Check whether the DAV bit = 1
        Call ibwrt(bd, "IOUT?")             'To clear the status register
        Call ibrd(bd, sOutputI)             'Dummy readout
    Next iForCounter

  '<Rush current measurement>
    Call ibwrt(bd, "OUT 1")                 'Turn on the output.
    Call ibwrt(bd, "IOUT?")                 'To clear the status register
    Call ibrd(bd, sOutputI)                 '  Dummy readout
    dOutputI = 0#                           'Real parameter initialization
    Do                                      'For the peak-hold current
        dPeakMaxI = dOutputI                '  Monitor the max. value (constant condition).
        Do                                  'Measurement end observation
          Call ibwrt(bd, "STS?")
          Call ibrd(bd, sStsRegister)
          iStsRegister = Val(Left$(sStsRegister, ibcntl))
          DoEvents                          '(For DoEvents, see the reference of VisualBasic.)
        Loop Until iStsRegister And 4       'Check whether the DAV bit = 1
        Call ibwrt(bd, "IOUT?")             'Peak current value readout
        Call ibrd(bd, sOutputI)
        dOutputI = Val(Left$(sOutputI, ibcntl))
'Convert the peak current value to a real number.
    Loop Until dPeakMaxI = dOutputI
    Call ibwrt(bd, "OUT 0")                 'Turn off the output.

    MsgBox "Rush Current = " + Str$(dPeakMaxI)
'Display the max. peak current as a rush current value.
```

Sample Program 7

This program describes the setting for generating a service request (SRQ) with the current limit and the processing after receiving SRQ.

```
'<<Generating SRQ with the current limit>>
  '<Parameter declaration>
    Dim sStbRegister As String          'Parameters for status byte register readout
                                         character strings
        sStbRegister = Space(128)
    Dim sFauRegister As String          'Parameters for fault register readout character strings
        sFauRegister = Space(128)
    Dim rsp As Integer                  'Declaration of the serial polling parameters

  '<Register setting for SRQ generation>
    Call ibwrt(bd, "FUNMASK 64")        'Permit the fault register current limit.
    Call ibwrt(bd, "UNMASK 1")          'Permit the status byte register FAU bit.
  '...
  '...
  '<Awaiting SRQ generation>
    Do
        Call ibrsp(bd, rsp)             'Serial polling execution
        DoEvents
    Loop Until rsp And 65               'Check whether the RQS + FAU bit = 1
  '<SRQ is generated!!>
    Call ibwrt(bd, "UNMASK 0")          'Forbid the FAU bit so as not to generate SRQ again.
    Call ibwrt(bd, "STB?")              'Read out the status byte register.
    Call ibrd(bd, sStbRegister)         '  Reset the FAU bit.
  '...
  '<Releasing the current limit>
  '...
    Call ibwrt(bd, "FAU?")              'Register readout.
    Call ibrd(bd, sFauRegister)         '  Bit resetting following release.
  '...
  '...
```

Sample Program 8

This program is used to read out alarm information.

```
'<<Alarm information readout>>
  '<Parameter declaration>
    Dim sAlarmInfo As String              'Parameters for the alarm-information readout
                                           character strings
        sAlarmInfo = Space(128)
    Dim sAlarmInfoPre As String           'Parameters for the previous alarm-information
                                           character strings
        sAlarmInfoPre = Space(128)
    Dim bAlarm As Integer                 'Alarm flag
        bAlarm = False

  '<Alarm information check>
    sAlarmInfo = "NG"                     'Alarm information initialization
    Do
        sAlarmInfoPre = sAlarmInfo        'Substitute the alarm information for the previous
                                           information.
        Call ibwrt(bd, "SELFTEST?")       'Alarm information readout
        Call ibrd(bd, sAlarmInfo)
        If 0 = InStr(sAlarmInfo, "OK") Then
'If an alarm is generated,
          bAlarm = True                   '  Set the alarm flag, and display the information.
          MsgBox "Alarm!! " + Left$(sAlarmInfo, ibcntl)
'For details on information, see
        End If                            '  "9.2 Measures to be taken in the Event of an Alarms"
        DoEvents                          '  in the PCR-W AC Power Supply Operation Manual.
    Loop Until 0 < InStr(sAlarmInfo, "OK") Or sAlarmInfoPre = sAlarmInfo

  '<Alarm information result processing>
    If bAlarm = True Then                 'If an alarm is generated,
        Call ibwrt(bd, "ALMCLR")          '  Clear the alarm.
    Else                                  '          If not generated,
        MsgBox "An alarm did not occur."  '  Display not generated.
    End If
```

Sample Program 9

This program is used to set the IB11/RS11 to the initial setting prepared at the factory before shipment.

```
'<<Reset all settings to the factory setting before shipment>>
    Call ibwrt(bd, "OUT 0")               'First, turn off the output.
    Call ibwrt(bd, "CLRMEMORY")           'For details on the CLRMEMORY command, see 5.8.3.
    Call ibwrt(bd, "SETINI@@")            'Setting value initialization (with hold-off)
```

Sample Program 10

This program is used to set the PCR-W AC Power Supplies to AC + DC mode, AC voltage 50 V, and DC voltage 50 V.

```
'<<Voltage setting in AC + DC mode>>
  '<Set each AC/DC voltage, etc.>
    Call ibwrt(bd, "OUT 0")              'Turn off the output to set the AC + DC mode.
    Call ibwrt(bd, "ACDC 2")             'Set the AC + DC mode.
    Call ibwrt(bd, "ACVSET 50")          'Set the AC voltage to 50 V.
    Call ibwrt(bd, "DCVSET 50")          'Set the DC voltage to 50 V.
    Call ibwrt(bd, "FSET 1.0")           'Set the frequency to 1 Hz.
    Call ibwrt(bd, "OUT 1")              'Turn on the output.
```

Sample Program 11

This program is used to set 110 V/60 Hz for Address 3, and 90 V/50 Hz for Address 7.

```
'<<Memory setting>>
  '<Memory setting for Address 3>
    Call ibwrt(bd, "MEMSTO 3,110,60,0")   'AC voltage: 110 V; frequency: 60 Hz; DC voltage: 0 V

  '<Individual memory setting for Address 7>
    Call ibwrt(bd, "ACVSET 90.0")         'Set the AC voltage at 90 V.
    Call ibwrt(bd, "VSTO 7")              'Enter the set AC voltage value into memory.
    Call ibwrt(bd, "FSET 50.00")          'Set the frequency at 50 Hz.
    Call ibwrt(bd, "FSTO 7")              'Enter the set frequency into memory.

  '<Checking the memory-setting contents>
    Call ibwrt(bd, "MEMSTO 7?")           'Send the Address 7 readout command.
    Dim sMemory7 As String
    sMemory7 = Space(128)
    Call ibrd(bd, sMemory7)               'Read out the memory-setting contents, and store
                                           them in parameters.
    MsgBox "Memory7 = " & Left$(sMemory7, ibcntl)  'Display the read-out contents.
```

[Description] Sample Programs

- The sample programs in this manual are described as examples of the use of command messages. Therefore, this is not an actual application software for practical use as is.

- The sample programs have been prepared under the following conditions.
  Personal computer used : IBM PC/AT compatible models
  OS : Windows 3.1/Windows 95
  Language used : Visual Basic 3.0, Visual Basic 4.0

  Module used (for GPIB interface)
  GPIB board : NI-488.2, NI-488.2M specified GPIB board (Manufactured by National Instruments)
  GPIB driver (16-bit) : GPIB.DLL (Manufactured by National Instruments)
  GPIB driver (32-bit) : GPIB-32.DLL (Manufactured by National Instruments)
  Module file for Visual Basic (16-bit) : NIGLOBAL.BAS, VBIB.BAS (Manufactured by National Instruments)
  Module file for Visual Basic (32-bit) : NIGLOBAL.BAS, VBIB-32.BAS (Manufactured by National Instruments)

* To use the GPIB board manufactured by National Instruments, it is necessary to install an exclusive driver in advance. This driver is attached to the GPIB board. For details on installation and configuration, see the GPIB board manual.

  Module used (for RS232C interface)
  RS-232C port : COM1
  RS-232 driver (16-bit) : RS232.DLL (Manufactured by Kikusui Electronics Corp.)
  RS-232 driver (32-bit) : RSDRV32.DLL (Manufactured by Kikusui Electronics Corp.)
  Module file for Visual Basic (16-bit) : RSCOMM16.BAS (Manufactured by Kikusui Electronics Corp.)
  Module file for Visual Basic (32-bit) : RSCOMM32.BAS (Manufactured by Kikusui Electronics Corp.)

* For use with other than Visual Basic, drivers are prepared for Visual C++, and Delphi. These drivers are uploaded to the following BBS for use.
  Upload BBS
  NIFTY-Serve : Windows communication environment forum (FWINCOM) [Communication tool] library #370
  CompuServe : Microsoft Basic forum (MSBASIC) 16-bit/32-bit OCX/DLL libraries
  These libraries are registered as RS232 Drivers For Instrumentation. (It is possible to conduct a search using the key-word RS232.)

Appendix 3 Guidance for Changing IB01-PCR Programs for Use on IB11

To apply the program prepared for the IB01-PCR (GPIB option of the conventional PCR series) to IB11, it is necessary to rewrite some commands and modify the program. The modification method required for this is described below.

Program modification location	Modification method
Locations where the response data content is identified using character Example 1: For WORD 1 The OUT? result is identified using ON or OFF. The RANGE? result is identified using l00V 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 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 the STATUS? command is used	Change the STATUS? command to the STB? or STS? command.
Locations where the WORD command is used	The IB11 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.
Locations where the ERR? command is used	Change bit assignments to those of IB11.
FSET command	If SIMMODE ON is set, set up OUT OFF and then execute the FSET command.
VLIM command	Change voltage upper limit setting to ACVHI.

To use commands for the IB01-PCR without modification, the [IB01PCR] command is required. For details, refer to "5.9.3 IB01-PCR Command Support".

INDEX

Commands

A

B

C

D

E

F

G

H

I

L

M

O

P

Q

R

S

T

U