PROGRAMMABLE AC/DC POWER SOURCE

KP2000AS

Instruction Manual (Remote Control)

NF Corporation

DA00104980-001

PROGRAMMABLE AC/DC POWER SOURCE

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Instruction Manual (Remote Control)

——— Preface ———

This instruction manual explains the remote interfaces of the Programmable AC/DC Power Source KP2000AS (hereinafter abbreviated as “KP2000AS”). For operations from the panel, see the instruction manual of the main unit.

The remote interface allows you to use not only the basic KP2000AS features (e.g., power source control and measurement function).

It also supports remote control commands for our high-efficiency system power supply P-STATION / EPO series (hereinafter abbreviated as EPO series).

- This manual consists of the following chapters.

When you use this product for the first time, start with "**1. Preparation before Use**."

1. **Preparation before Use**
   Explains the setting of the remote interface.
2. **Status System**
   Explains the content of service requests (SRQ) and status bytes.
3. **Remote Command Overview**
   Explains the remote command formats accepted by the KP2000AS.
4. **Remote Command Reference**
   Includes the list of KP2000AS remote commands and descriptions for each command.
5. **Programming Sample**
   Explains the programming samples for remote-controlling the KP2000AS.
6. **Error Message List**
   Includes the list of error messages replied by the KP2000AS in response to remote commands.
7. **Specifications**
   Includes the specifications of the remote interface.

For KP2000AS, the GPIB interface is an option when specified at the order.

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1.Preparation before Use

1.1 Overview

The KP2000AS supports following four types of remote interfaces:

■USB(USB Test and Measurement Class USB488 Subclass, abbreviated to USBTMC hereinafter)
■GPIB(specified at the order)
■RS232
■LAN

The KP2000AS is provided with the USB, RS232, GPIB(specified at the order) and LAN remote interfaces and is remote-controllable by a computer or other instruments. By sending remote commands for each function and receiving the data, you can control the function execution and read the internal state such as setting values and error statuses.

Regardless of which communication interface is used, you can create and use a program that uses the Virtual Instrument Software Architecture (VISA) library. If you do not have a license to use VISA library, you need to obtain one (generally, it requires some cost).

Irrespective of differences in interface, each function can be used with the same command from the remote interface. However, some functions are not available in the RS232 and LAN due to interface-specific restrictions.

[Restrictions in RS232 and LAN]

- ☐ Status and register acquisition method
  Serial poll-based status register acquisition is not available.
  For details, see ***2.2***.

- ☐ Handling of termination symbol at command send/receive
  The RS232, LAN always requires a termination symbol.

- ☐ Binary data handling
  Arbitrary waveform data in binary data cannot be sent.

- ☐ Remote/Local state transition condition
  The RS232, LAN cannot perform the state transition from Remote to Local using the remote command. Only the panel operation can change the state to Local.

Command control specification: IEEE Std. 488.2-1992 compatible

(Some commands are omitted or extended depending on the interface.)

Command format specification: compliant with the SCPI Specification 1990.0 command system

1.2 USB Preparation

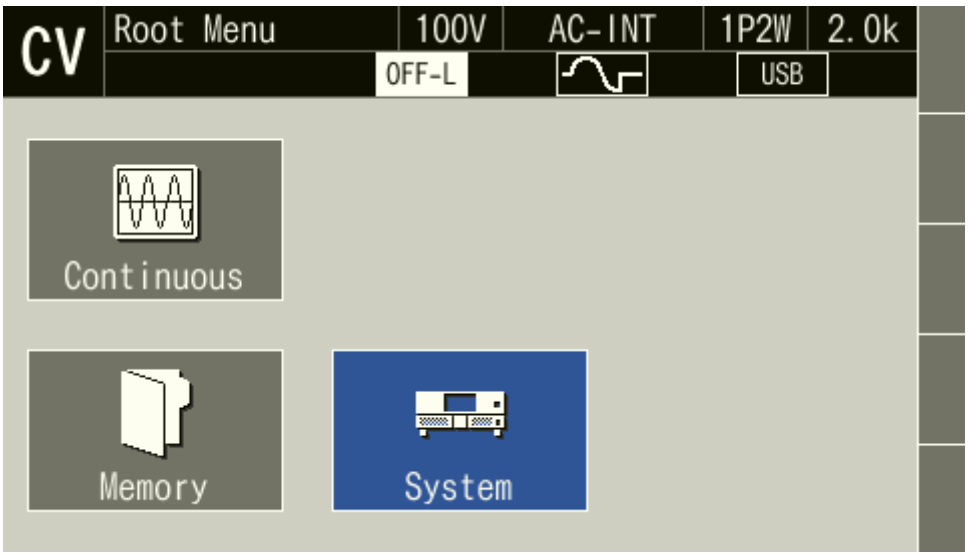
■ USB interface (USB2.0 Full Speed, USBTMC)

Item	Description
ID	Already assigned for each device
Terminator	“LF”

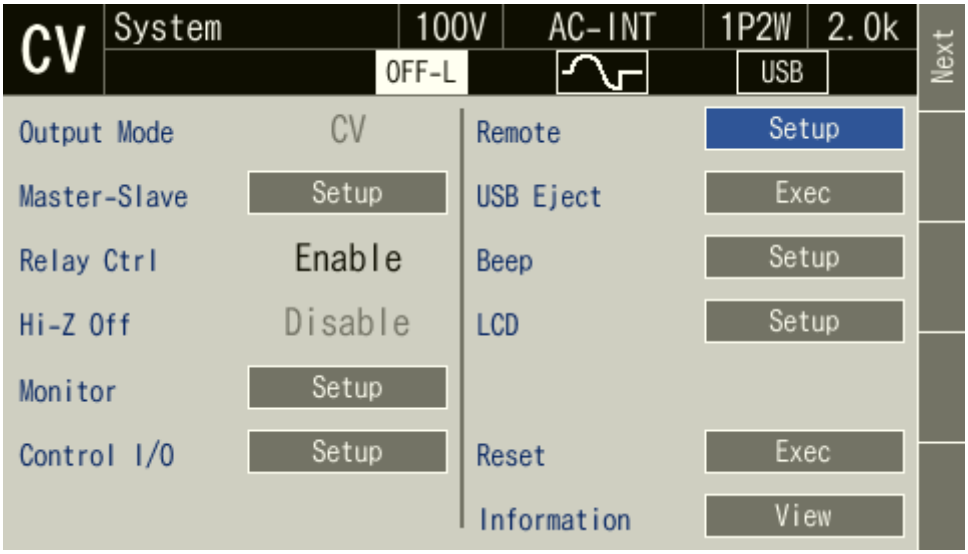
The computer used for control needs a USBTMC class driver installed on it. The USBTMC class driver is included in the hardware and software product of each company that provides the VISA library.

■ Operation procedure

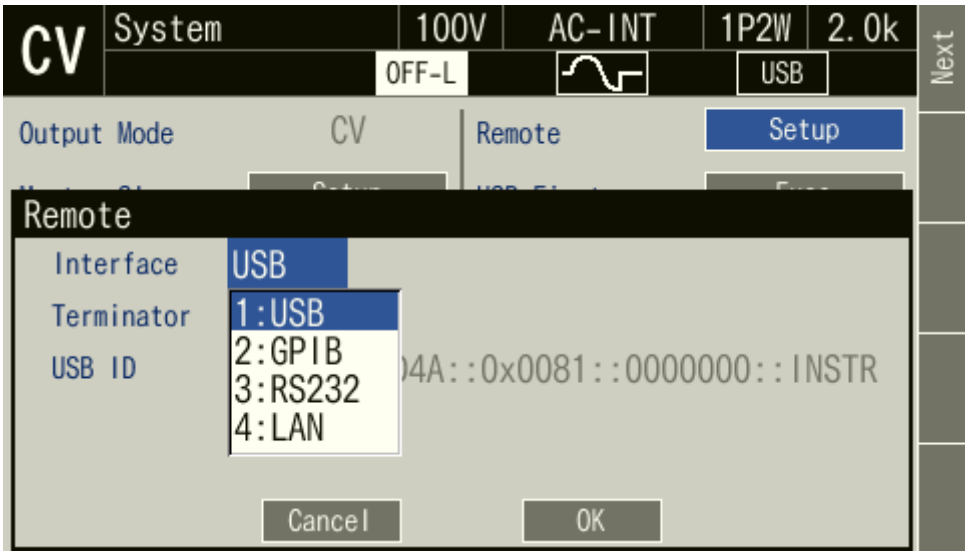
1. Press the MENU key to move to the root menu, then select [System]. The system setting window opens.



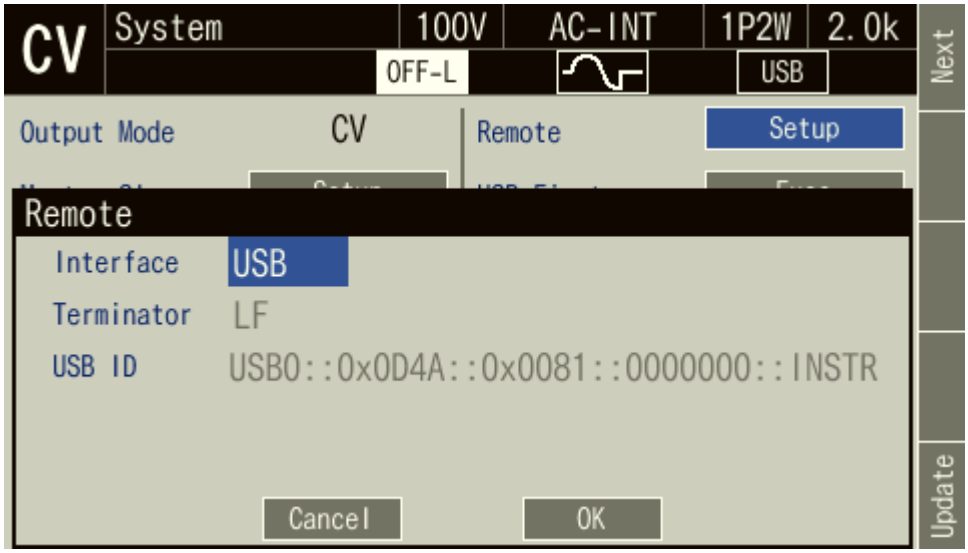
2. Put the cursor on [Setup] next to the [Remote] item, then press the ENTER key. The remote setting window opens.



3. In the [Interface] item, select [USB].



4. The window shows [Terminator] and [USB ID]. For the USB ID, see the explanation in the next section. Select [Close] to close the window.



5. Use a commercially available USB cable (Type A to B) to connect this product to the computer. USB connector is available on the rear of this product.

---- Notes ----------

- Avoid use in a place that has under electrically noisy environment.
- It is recommended to use a fully-shielded, short cable.
- The use of USB hub may cause the product not to communicate properly.

■ About USB ID

Used for a system connected with multiple KP2000AS through USB, to enable the application identify each source. The USB ID is represented in the following format.

USB0::[Vendor number]::[Product number]::[Serial number]::INSTR

Vendor number: Fixed to 3402 (0x0D4A)
Product number: Fixed to 129 (0x0081)
Serial number: A unique number (serial number) has been set for each product.

1.3 GPIB Preparation

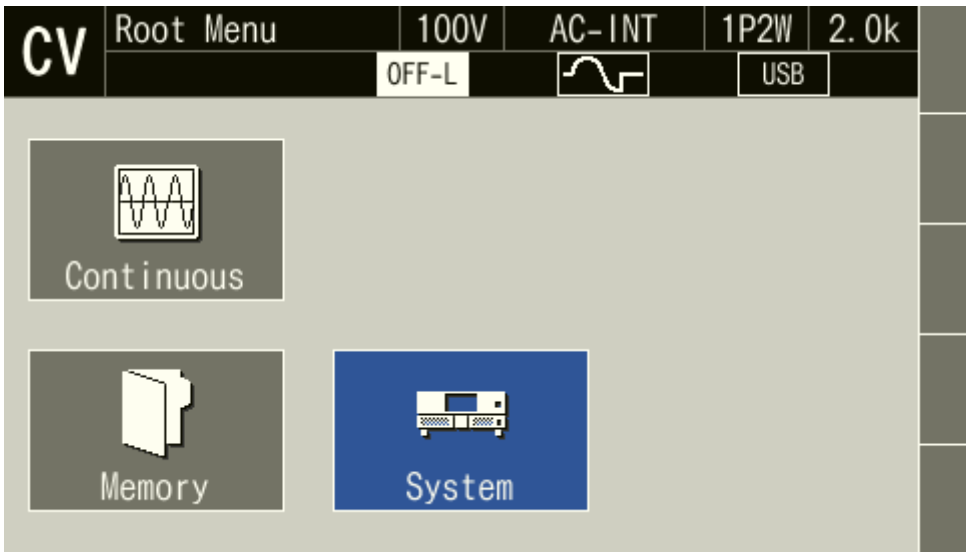
■ GPIB interface (specified at the order, IEEE488.1 std 1987 compliant)

Item	Description or Selection	Factory default
Address	0 to 30	2
Terminator	“LF”	

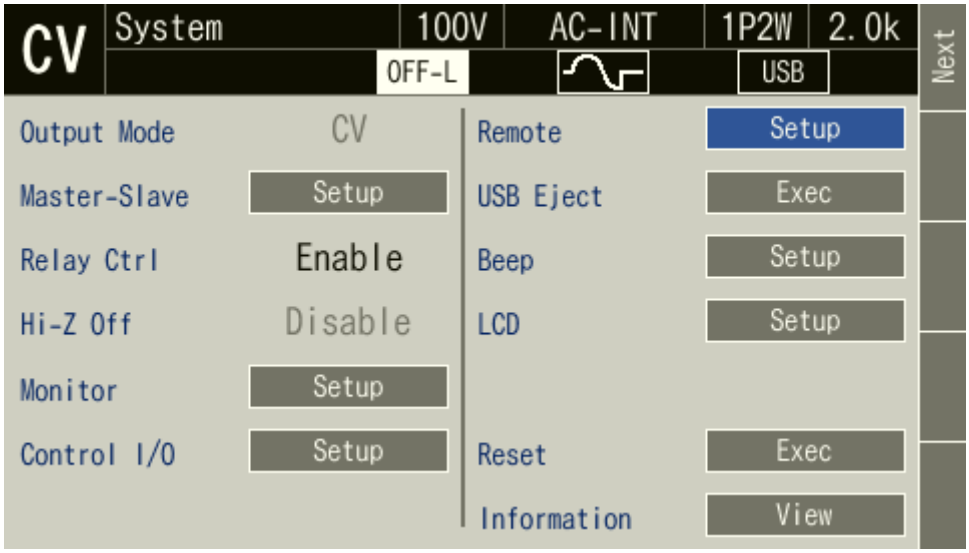
Mount a GPIB controller board (card) to the controlling computer, then connect between them using a commercially-available GPIB cable. For details, see the instruction manual of your GPIB controller board (card).

■ Operation procedure

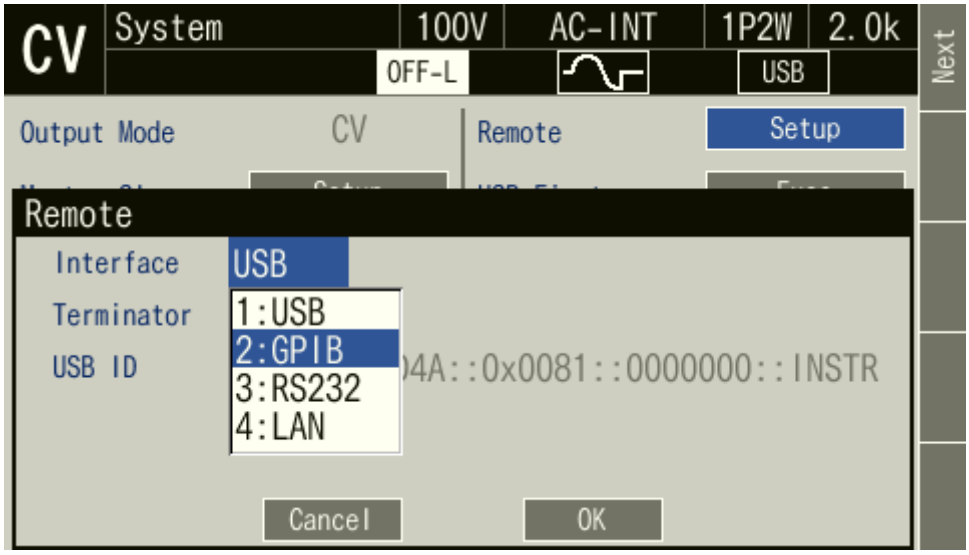
1. Press the MENU key to move to the root menu, then select [System]. The system setting window opens.



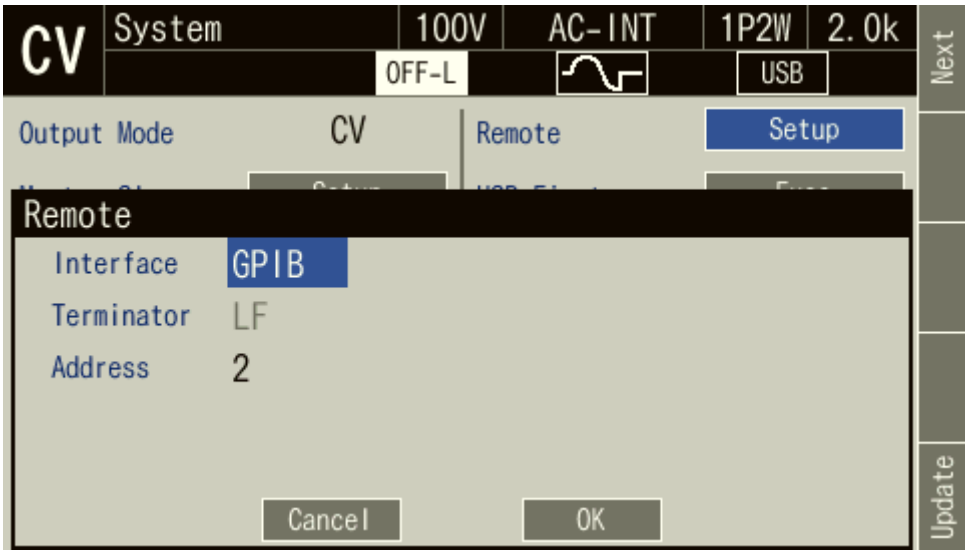
2. Put the cursor on [Setup] next to the [Remote] item, then press the ENTER key. The remote setting window opens.



3. In the [Interface] item, select [GPIB].



4. In the [Address] item, set the address. [Terminator] is fixed to "LF".



5. Use a GPIB cable to connect this product to the computer. GPIB connector is available on the rear of this product. Turn off this product and the computer before connecting or disconnecting the cable.

---- Notes----------

- Avoid use in a place that has under electrically noisy environment.
- Before connecting or disconnecting the connector, turn off the power to all devices on the bus.
- When using the GPIB, turn on the power to all devices on the bus.
- Ensure that the total cable length is within 20 meters.
- Ensure that the length of one cable is within 4 meters.
- Do not set the same address as the one used for any other device connected to the same bus. Otherwise, the product cannot communicate properly.

1.4 RS232 Preparation

■ RS232 interface

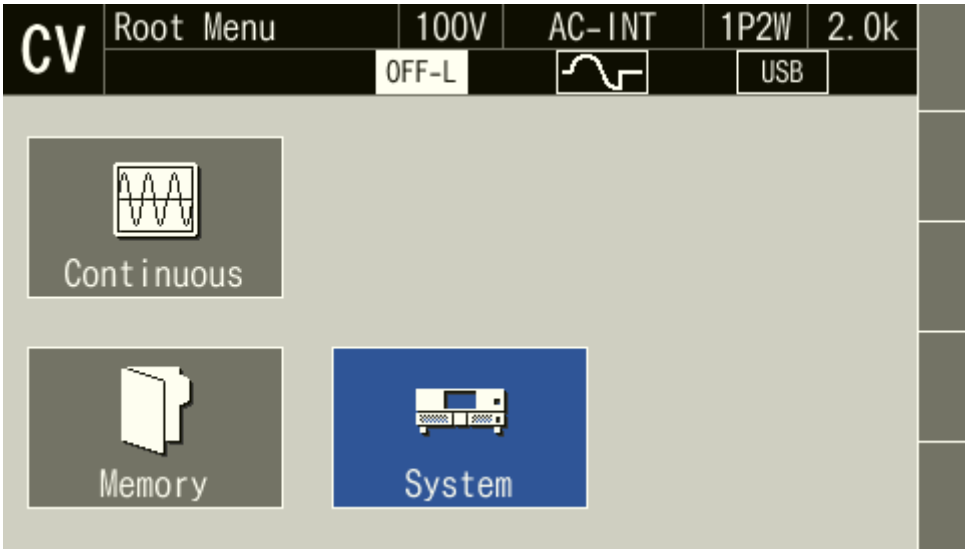
Item	Description or Selection	Factory default
Terminal	D-sub 9-pin (male)	
Baud rate	9600 / 19200 / 38400	9600bps
Terminator	“CR”“LF” / “CR” / “LF”	“CR” “LF”
Parity	None/Odd/Even	None
Stop bit	1 / 2	1 bit
Data bit	7 / 8	8 bit
Flow control	None/Hardware/Software	None

Note: Binary transmission is not supported.
Remote command based arbitrary waveform transmission is not available.

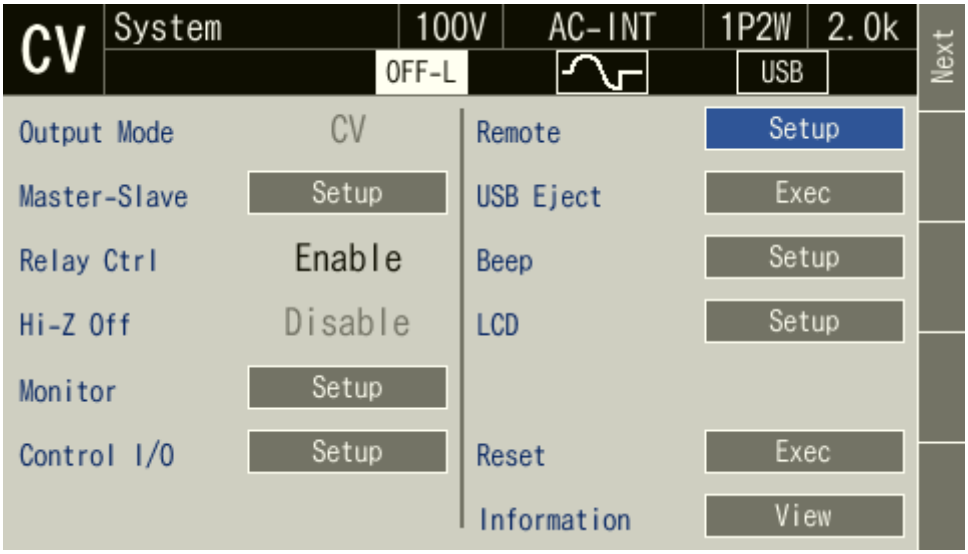
Note: Use a cross cable.

■ Operation procedure

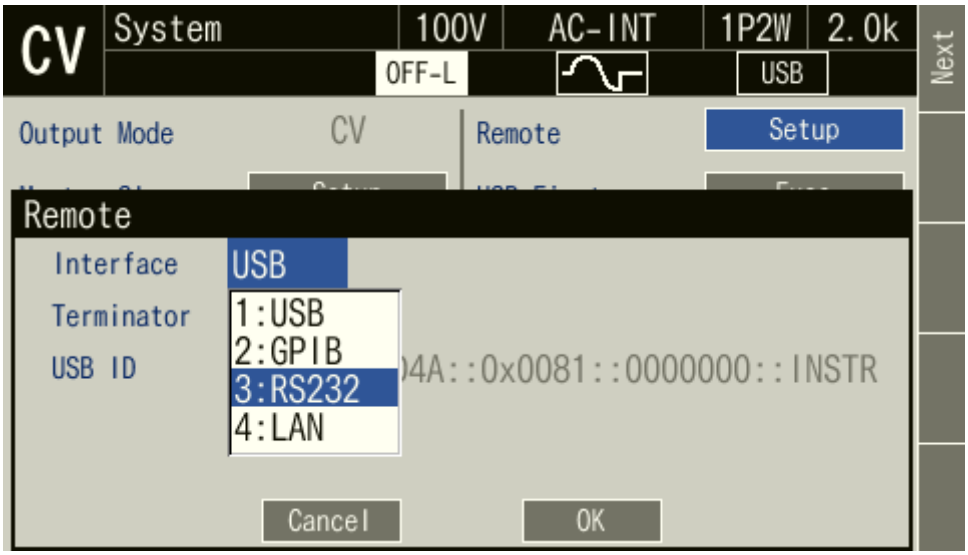
1. Press the MENU key to move to the root menu, then select [System]. The system setting window opens.



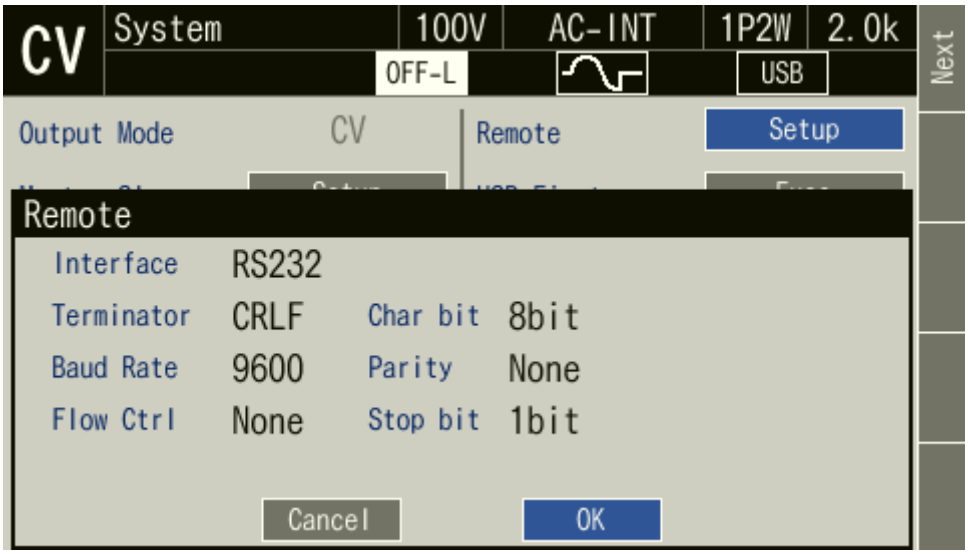
2. Put the cursor on [Setup] next to the [Remote] item, then press the ENTER key. The remote setting window opens.



3. In the [Interface] item, select [RS232].



4. Set each item.



5. Use a D-sub 9-pin cross cable to connect this product to the computer. RS232 connector is available on the rear of this product.

---- Notes----------

- Avoid use in a place that has under electrically noisy environment.
- It is recommended to use a fully-shielded, short cable.

1.5 LAN Preparation

■ LAN interface

(10BASE-T / 100BASE-TX, AutoMDI/MDI-X, SCPI-RAW : port TCP 5025)

Item	Description or Selection **Note 1**		Factory default
DHCP	Enable / Disable Enable : DHCP and Auto-IP function can be used. Disable : The fixed IP address can be used.		Enable
MAC Address	Already assigned for each device		
IP Address	A	0.0.0.0 - 255.255.255.255	169.254.***.*** (“***”shows automatically assigned by the LAN interface.)
	B	169.254.1.0 - 169.254.254.255	
	C	Automatically assigned by the DHCP.	Automatically assigned by the DHCP.
Subnet Mask	A	0.0.0.0 - 255.255.255.255	255.255.0.0
	B	255.255.0.0	
	C	Automatically assigned by the DHCP.	Automatically assigned by the DHCP.
Default Gateway	A	0.0.0.0 - 255.255.255.255	169.254.***.*** (The same value with the ip address.)
	B	169.254.1.0 - 169.254.254.255	
	C	Automatically assigned by the DHCP.	Automatically assigned by the DHCP.
Terminater	“LF”		

Note 1 : A – C in the table above are the condition of the network connection.

These shows following:

A : When “DHCP” is “Disable”.

B : When “DHCP” is “Enable”, and no DHCP server.

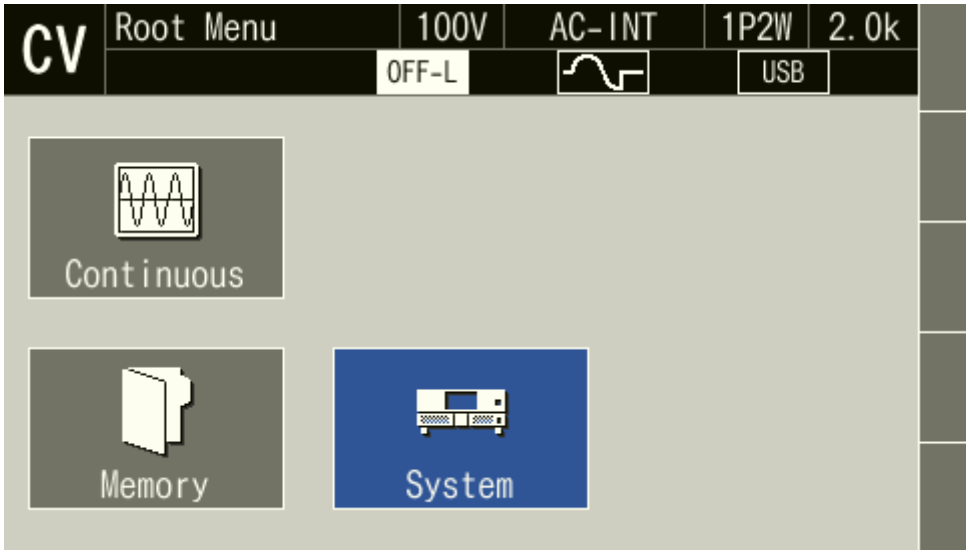
C : When “DHCP” is “Enable”, and a DHCP server is connected.

Note: Binary transmission is not supported.

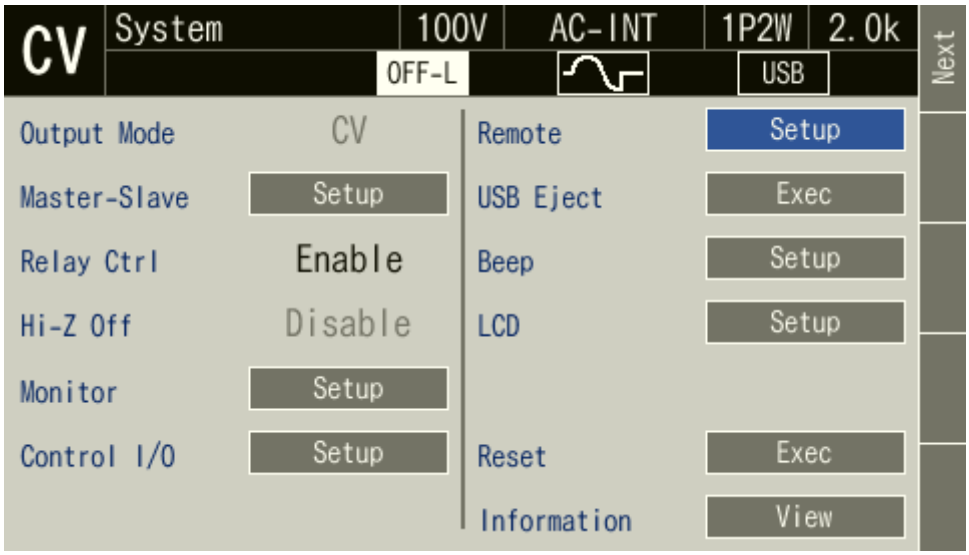
Remote command based arbitrary waveform transmission is not available.

■ Operation procedure

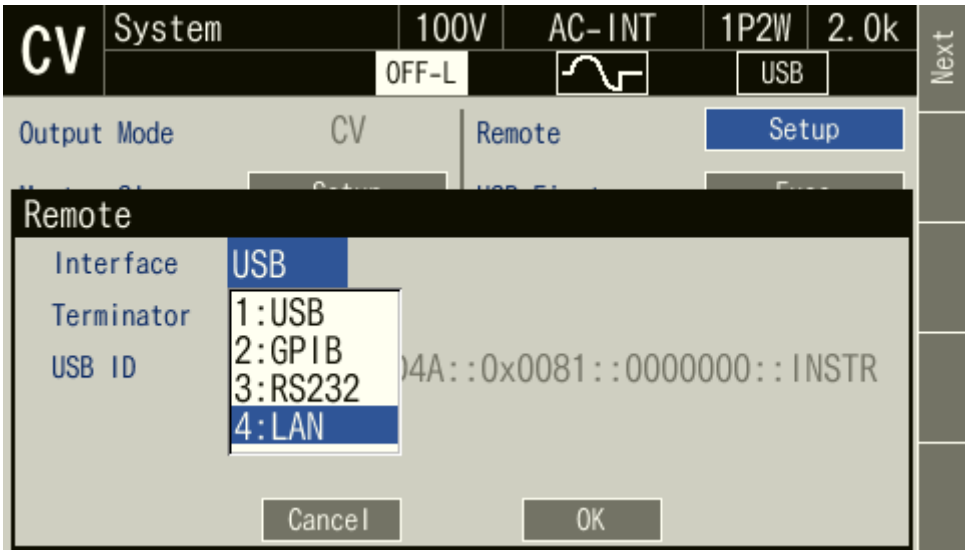
1. Press the MENU key to move to the root menu, then select [System]. The system setting window opens.



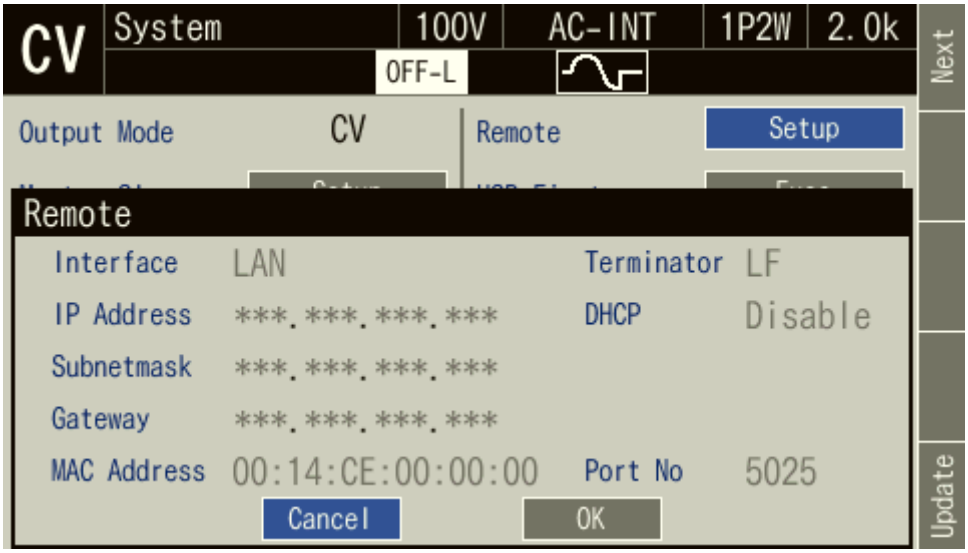
2. Put the cursor on [Setup] next to the [Remote] item, then press the ENTER key. The remote setting window opens.

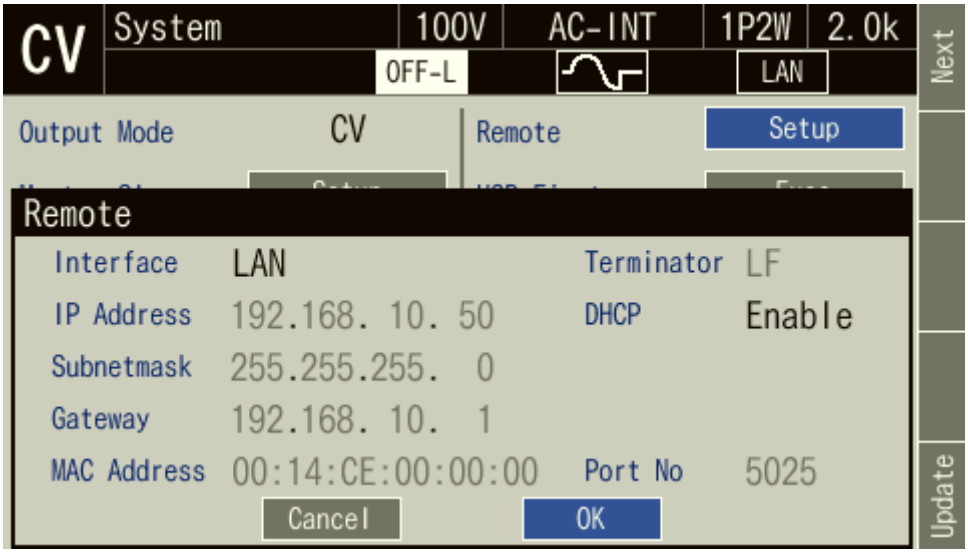


3. In the [Interface] item, select [LAN].



4. The current [MAC Address], [IP Address], [Subnetmask] and [Gateway] are shown. When not using fixed IP, undetermined parameters are shown by "***". After assignment, these will be updated.





5. Connect this product to a hub or computer with a commercially available LAN cable. LAN connector is available on the rear of this product.

---- Notes ----------

- Avoid use in a place that has under electrically noisy environment.

1.6 About Remote and Local

1.6.1 Remote State

In the Remote state, the control panel key operations are not accepted. However, the output off (OUTPUT key) and the switching to the Local state (SHIFT + 0) are available.

■ Switching to the Remote state

When communication is established after the command is sent from the computer to the product, the KP2000AS switches to the Remote state.

1.6.2 Local State

Control panel key operations are accepted.

■ Switching to the Local state

The Shortcut operation SHIFT + 0 switches the state to Local.

The Remote state is cleared when the LOCAL key is pressed in the Remote state, when REN is set to False from the computer, or when the GTL command is received. However, the LOCAL key is disabled when the KP2000AS is in the local lockout state. To clear the local lockout status, you need to set the REN to False on the computer.

1.7 Considerations

1.7.1 Considerations Common to the Interfaces

- The input buffer size is 36864 bytes.
  The KP2000AS interprets and executes the commands sequentially as it stores received commands to the input buffer. It can also handle a data of more than the size of the input buffer, where the data includes one statement which consists of multiple commands concatenated together and is terminated with the message terminator (delimiter symbol or EOI). However, the input buffer becomes full if the communication data volume is too large compared to the speed of command interpretation and execution. In that case, the computer cannot send any command, and therefore results in transmission timeout.

  Note that the transmission timeout does not occur if the communication is taking place with the RS232 flow control set to None. However, other error occurs such as command execution error because the command sent from the computer is not received correctly by the KP2000AS.

  If there is an error during interpretation or execution of any one of the multiple commands that are concatenated and sent to the KP2000AS, any commands after that command up to the message terminator are discarded; not interpreted or executed.

- The output buffer size is 4096 bytes.
  The output buffer is cleared if the size of the response data in reply to the query command from the computer exceeds the output buffer size. At this time, the KP2000AS sets the query error bit of the standard event status register to 1.

  During the processing of data that includes multiple commands concatenated up to the message terminator (delimiter symbol or EOI) in one statement, if the size of the response data exceeds the output buffer size, the command parsing and execution is continued while the excess response data does not remain in the output buffer.

- The maximum number of errors that can be queued is 16.
  Every time a command parsing and execution error occurs, the error message is queued in the error queue. If command errors occur beyond the maximum queuing number of errors, the error message stored in the 16th queue is replaced with -350,"Queue overflow."

- The USB, RS232, GPIB and LAN interfaces are expected to be used under a relatively stable environment. Avoid using in a place that has power fluctuation or environment with much electrical noise.

---- Restrictions----------

- Do not insert or remove a USB memory while the main unit is performing the remote communication. This may damage the USB memory or cause the main unit to malfunction.
  Insert or remove a USB memory after terminating the remote command based auto-execution program and similar activities.

1.7.2 USB Interface

- To use a USB interface, USBTMC device driver software needs to be installed on your computer.

- Not that not all USBTMC device driver software pieces provided by every company have been tested for operation verification.

  Operation verification was performed on our USBTMC compatible device driver software (dedicated to the attached application) and the USBTMC device driver software that comes with NI-VISA provided by National Instruments.

1.7.3 GPIB Interface

- Power off all devices on the bus when you connect or disconnect the GPIB cable.

- When using the GPIB, turn on the power to all devices connected to the bus.

- Up to 15 devices (including the controller) can be connected to the GPIB in one system.
  The cable length has the following limitations.
  - •Total cable length is 2 meters x (number of devices) or 20 meters, whichever the shorter
  - •Length of a cable is 4 meters or less

- Check carefully for the GPIB address before setting it. Using a duplicated address in one system may damage devices.

- Inconsistency of the delimiter settings in the system might cause unexpected trouble. Use the same delimiter setting for every device that exists in the system.

1.7.4 RS232 Interface

- One RS232 port cannot have multiple devices connected at one time.

- When communication is taking place with no flow control, the command may not be executed properly. Use the flow control whenever possible.

- For communication that has the hardware flow control enabled, use a cable in which the RTS signal and CTS signal lines are interlink-connected. Use the one that RTS on the computer side is connected to CTS on the KP2000AS, CTS to RTS.

- To avoid malfunctioning due to radiated electromagnetic noise, ensure to use a shielded cable.

1.7.5 LAN Interface

- If you set “DHCP” to “Disable” (manually determining IP address), be careful not to set the same IP address to the other device.

- Use an appropriate cable for connection to your network.

2.Status System

2.1 Service Request

The USB and GPIB interface supports the service request functions.
You can obtain the status of the KP2000AS product by performing a serial poll (reading status byte) from your computer, under the conditions shown below. The serial poll allows you to obtain the status of the KP2000AS product regardless of the Remote/Local state.

- When the output data for query is prepared
- When some error or warning occurs

2.2 Status Byte

The status byte can be obtained by a serial poll only when using USB or GPIB interface. When using a RS232 or LAN interface, the status byte cannot be obtained by a serial poll.

2.2.1 Status Byte Register and Service Request

The configuration of the status byte register and the service request enable register is shown in Figure 2.1.

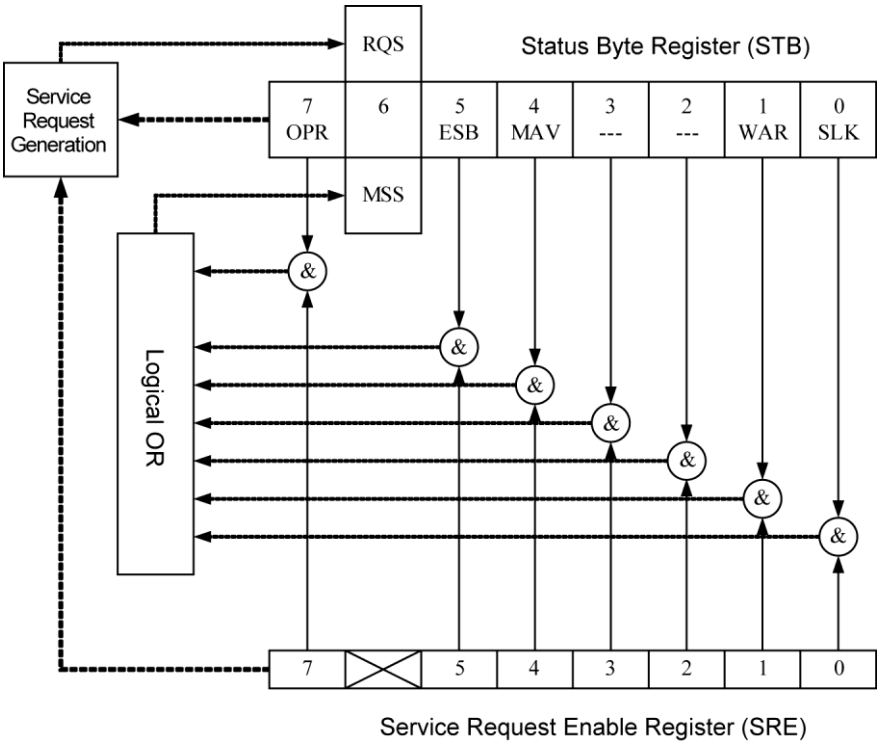


Figure 2.1 Status Byte Register and Service Request Enable Register

2.2.2 Status Byte Register

Each bit of the status byte register is described in Table 2.1.

Table 2.1 Status Byte Register

Bit	Weight	Symbol	Description	Set Condition (set to 1)	Clear Condition (set to 0)
(MSB) 7	128	OPR	Operation condition register summary	This bit is set when the logical OR of bits of the operation event register is 1.	This bit is cleared when the logical OR of bits of the operation event register is 0.
6	64	RQS/ MSS	Request service/master summary status	Note 3	Note 1
5	32	ESB	Standard Event Status Register Summary	This bit is set when the logical OR of bits of the standard event status register is 1.	This bit is cleared when the logical OR of bits of the standard event status register is 0.
4	16	MAV	This bit notifies that the output data for the query is prepared.	This bit is set when the output data for the query is prepared.	This bit is cleared when there is no output data for the query. Note 4
3	8	Unused	Unused	Note 2	Note 2
2	4	Unused	Unused	Note 2	Note 2
1	2	WAR	Warning condition register summary	This bit is set when the logical OR of bits of the warning event register is 1.	This bit is cleared when the logical OR of bits of the warning event register is 0.
(LSB) 0	1	SLK	System Lock condition register summary	This bit is set when the logical OR of bits of the System Lock event register is 1.	This bit is cleared when the logical OR of bits of the System Lock event register is 0.

Note 1 : • When a device clear (DCL or SDC) is received.
• After reading the status byte (reading the status byte by a serial poll during the SRQ output or a query message).

Note 2 : • Always 0 because this bit is not used.

Note 3 : • In case of reading by a serial poll, this bit is set when the SRQ is sent.
• In case of reading by a query message, this bit is set if the logical OR of bits of the status byte is 1.

Note 4 : • When a device clear (DCL or SDC) is received.
• USB : After reading the status byte by using a query message.
When using USB, this bit is not cleared by a serial poll.

The status byte register is cleared when a *CLS command is received.

2.2.3 Service Request Enable Register

The service request enable register is used to select the summary bit within the status byte register that generates service requests shown in Figure 2.1.

2.2.4 Standard Event Status Register Group

The configuration of the standard event status register group is shown in Figure 2.2.

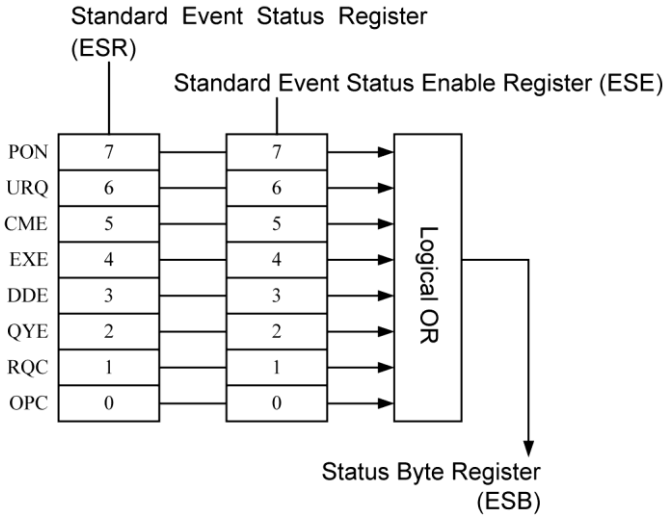


Figure 2.2 Standard Event Status Register Group

2.2.4.1 Standard Event Status Register

Each bit of the standard event status register is described in Table 2.2.

Table 2.2 Standard Event Status Register

Bit	Weight	Symbol	Description
7	128	PON	Power on
6	64	URQ	User request
5	32	CME	Command error
4	16	EXE	Execution error
3	8	DDE	Equipment-specific error
2	4	QYE	Query error
1	2	RQC	Request control
0	1	OPC	Operation completion

The standard event status register is cleared when the *ESR? query or *CLS command is received.

2.2.4.2 Standard Event Status Enable Register

The standard event status enable register is used to select the bit of the standard event status register as shown in Figure 2.2, and reflect the status of the selected bit to the ESB of the status byte register.

2.2.5 Operation Status Register Group

The configuration of operation status register group is shown in Figure 2.3.

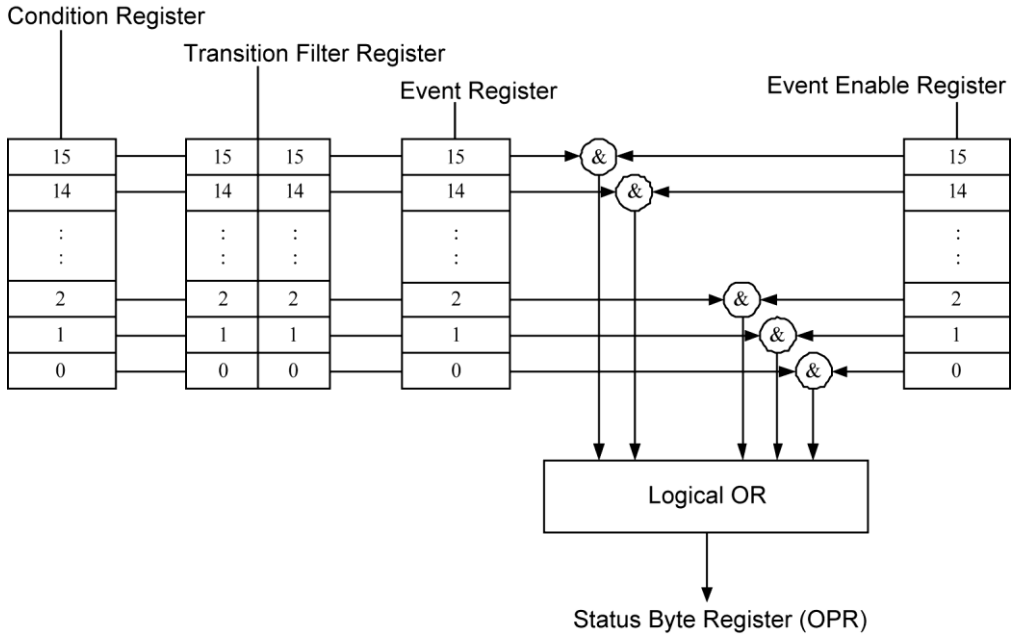


Figure 2.3 Operation Status Register Group

2.2.5.1 Operation Status Condition Register

The operation status condition register is a register that represents the current status of the device. This register is not cleared even when a query addressed to the condition register is received.

Each bit of operation status register group is described in Table 2.3.

Table 2.3 Operation Status Register

Bit	Weight	Description
15	-	Always 0
14	-	(Unused)
13	-	(Unused)
12	-	(Unused)
11	-	(Unused)
10	-	(Unused)
9	512	Measured value overrange
8	256	LOCK status (SYNC status)
7	-	(Unused)
6	-	(Unused)
5	-	(Unused)
4	-	(Unused)
3	8	Soft start or soft stop status(Sweep status)
2	-	(Unused)
1	2	Busy status
0	-	(Unused)

2.2.5.2 Operation Status Transition Filter

The operation status transition filter is a filter for determining the event bit transition.

The operation status transition filter is not cleared even when the *CLS command is received.

The relationship between the transition filter setting and the event register transitions is shown in Table 2.4.

Table 2.4 Transition Filter and Event Register Transitions

Each Bit Setting of Positive Transition Filter	Each Bit Setting of Negative Transition Filter	Transition of Condition Register to Set the Bit of Event Register to 1
0	0	Not changed
0	1	1 → 0 (detects the falling)
1	0	0 → 1 (detects the rising)
1	1	0 → 1 or 1 → 0

2.2.5.3 Operation Status Event Register

The operation status event register is a register that reflects the changes of the condition register according to the transition filter setting.

The event register is cleared upon reception of a query addressed to the event register or the *CLS command.

2.2.5.4 Operation Status Event Enable Register

The operation status event enable register is used to select bits in the event register to be summarized.

2.2.6 Warning Condition Register Group

The configuration of the warning condition register group is shown in Figure 2.4.

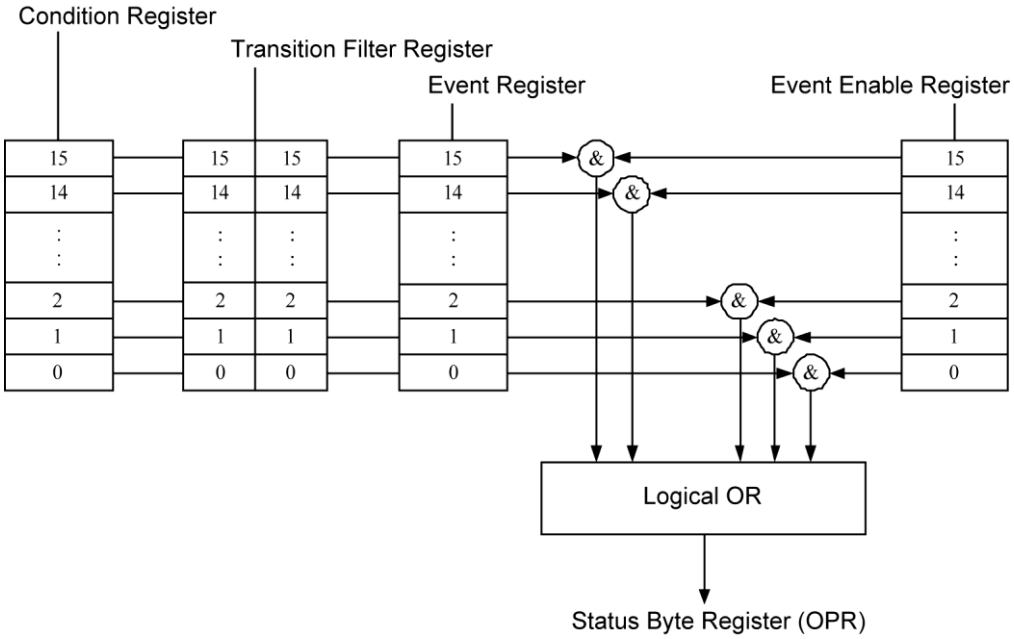


Figure 2.4 Warning Condition Register Group

2.2.6.1 Warning Condition Register

This register is not cleared even when a query addressed to the condition register is received.

Each bit of the warning condition register is described in Table 2.5.

Table 2.5 Warning Condition Register

Bit	Weight	Description
15	-	Always 0
14	16384	Peak current limiter is operating
13	8192	RMS current limiter is operating
12	4096	Active wattage limiter is operating
11	2048	Output OFF after peak current limiter is activated
10	1024	Output OFF after RMS current limiter is activated
9	512	Sensing voltage anomaly
8	256	Power unit DCPS anomaly
7	128	Synchronization frequency anomaly
6	64	Overheat
5	32	Power unit DCPS overvoltage
4	16	Power unit DCPS undervoltage
3	8	Output overcurrent (Peak)
2	4	Power unit anomaly
1	2	Output overcurrent (RMS)
0	1	Output overvoltage

2.2.6.2 Warning Status Transition Filter

The warning status transition filter is a filter for determining the event bit transition.

The warning status transition filter is not cleared even when the *CLS command is received.

For the relationship between the transition filter setting and the event register transitions, refer to Table 2.4.

2.2.6.3 Warning Event Register

The warning event register is a register that reflects the changes of the condition register according to the transition filter setting.

The event register is cleared upon reception of a query addressed to the event register or the *CLS command.

2.2.6.4 Warning Event Enable Register

The warning event enable register is used to select bits in the event register to be summarized.

2.2.7 System Lock Condition Register Group

The configuration of the System Lock condition register group is shown in Figure 2.5.

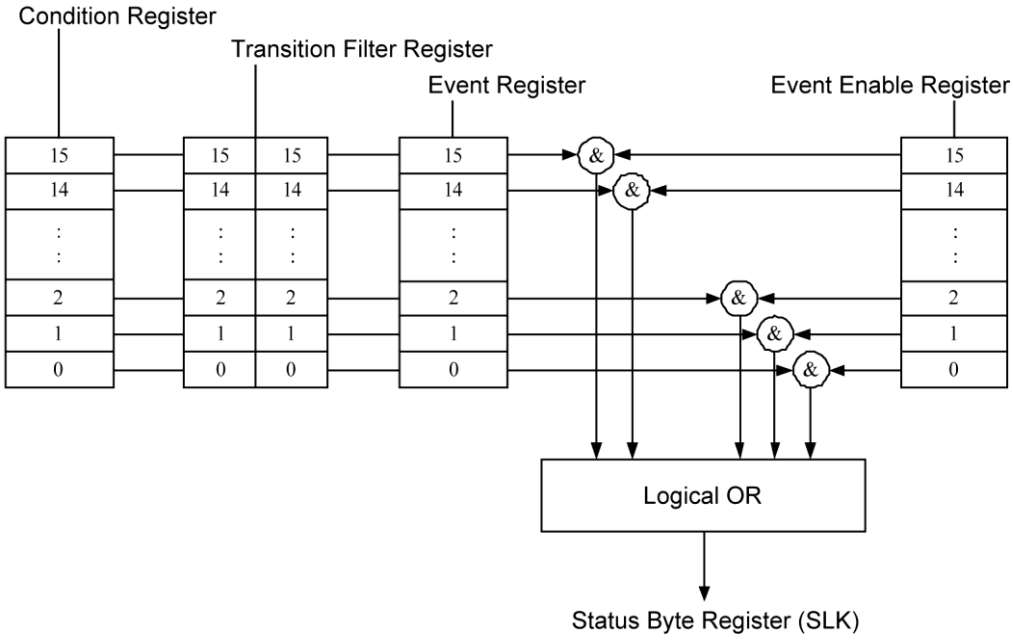


Figure 2.5 System Lock Condition Register Group

2.2.7.1 System Lock Condition Register

This register is not cleared even when a query addressed to the condition register is received.

Each bit of the System Lock condition register is described in Table 2.6.

Table 2.6 System Lock Condition Register

Bit	Weight	Description
15	-	Always 0
14	16384	(Unused)
13	8192	(Unused)
12	4096	(Unused)
11	2048	(Unused)
10	1024	(Unused)
9	512	Shut down
8	256	Cabinet connect mismathed
7	128	System settings mismatched between cabinet
6	64	Internal auxiliary power anomaly
5	32	Multi-unit system communication anomaly
4	16	Internal communication anomaly 2
3	8	Internal communication anomaly 1
2	4	(Unused)
1	2	Power input undervoltage
0	1	Power input overvoltage

2.2.7.2 System Lock Status Transition Filter

The System Lock status transition filter is a filter for determining the event bit transition.

The System Lock status transition filter is not cleared even when the *CLS command is received.

For the relationship between the transition filter setting and the event register transitions, refer to Table 2.4.

2.2.7.3 System Lock Event Register

The System Lock event register is a register that reflects the changes of the condition register according to the transition filter setting.

The event register is cleared upon reception of a query addressed to the event register or the *CLS command.

2.2.7.4 System Lock Event Enable Register

The System Lock event enable register is used to select bits in the event register to be summarized.

3.Remote Command Overview

3.1 Remote Command

3.1.1 Command Type and Format Concept

There are two types of remote commands of KP2000AS; the common commands defined in IEEE488.2, and the commands defined according to SCPI (Standard Commands for Programmable Instruments) command specifications.

3.1.2 About SCPI

SCPI is a standard that defines the communication method between external controllers and measuring instruments.
For general information about SCPI, refer to the following document:

Standard Commands for Programmable Instruments (SCPI) VERSION 1999.0
http://www.ivifoundation.org/scpi/

Conventions

The commands mentioned in the description are written following conventions:

< >	< > indicates something other than itself. In the case of parameter or response data, the abbreviation of the type is enclosed in < >. <NL> indicates an ASCII character that has the value of 10 decimal, and similarly, <^END> indicates EOI.
[ ]	The items enclosed in [ ] are optional. Note that "[" and "]" are not part of the command.
{abc|xyz}	Means that either "abc" or "xyz" should be used.
[abc|xyz]	Indicates that either "abc" or "xyz" can be used, but both are optional.
Uppercase, lowercase	A whole word consisting of the combination of upper and lowercase letters makes a long form of the keyword, while an uppercase only part makes a short form.

3.1.3 Supported Common Command

The KP2000AS supports the instrument common commands which comply with the IEEE488.2 standard.

All common commands begin with an asterisk (*), and some of them can use parameters.

The header of common command and the first parameter must be separated by a space code. The common commands supported by the KP2000AS are shown in Table 3.1.

Table 3.1 IEEE488.2 Common Commands Supported by KP2000AS

Command Query	Name
*IDN?	Identification Query
*RST	Reset Command
*TST?	Self-Test Query
*OPC	Operation Complete Command
*OPC?	Operation Complete Query
*WAI	Wait-to-Continue Command
*CLS	Clear Status Command
*ESE	Standard Event Status Enable Command
*ESE?	Standard Event Status Enable Query
*ESR?	Standard Event Status Register Query
*SRE	Service Request Enable Command
*SRE?	Service Request Enable Query
*STB?	Read Status Byte Query

3.1.4 EPO Command

KP2000AS can accept some EPO series command syntax. You can get a response by querying a command by adding ? at the beginning of the command string.

For example, if you want to get range, query "?RNG".

3.1.5 SCPI Command and Query Format

A SCPI command has a hierarchical structure that consists of a root keyword, one or more lower-level keywords, parameters, and suffixes.
The followings show examples of command and query.

:OUTPut:STATe ON<NL><^END>
:OUTPut:STATe?<NL><^END>

OUTPut is the root-level keyword that links second-level keywords. ON is a command parameter.

3.1.6 SCPI Subsystem Command Tree

3.1.6.1 Structure of Command Tree

SCPI applies a hierarchical structure similar to the one used in a file system to subsystem commands. In SCPI, this command structure is called a command tree, and Figure 3.1 shows an example of a command tree.

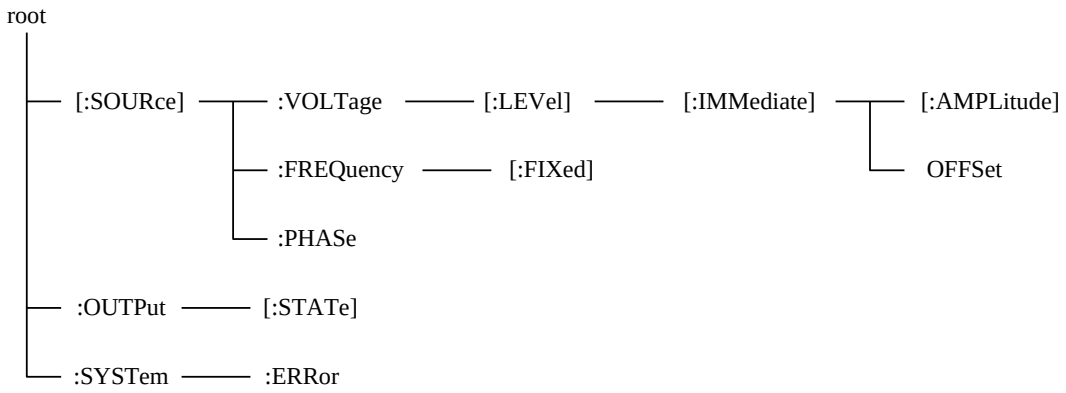


Figure 3.1 Example of Command Tree

In the command tree shown in Figure 3.1, the keywords closest to the top ("[:SOURce]", ":OUTPut", and ":SYSTem") are root-level keywords. To reach a lower-level keyword, you must follow the path of keywords defined above it.
For example, to access ":OFFSet", the command should be specified by following the path [:SOURce] - :VOLTage - [:LEVel] - [:IMMediate] - :OFFSet.

3.1.6.2 Current Path Movement

The current path is a level within the command tree, and becomes the first command path from which the command parser starts the search when the next command is sent. The command parser determines the current path according to the following rules.

(1)At power-on and reset

The current path is set to the root.

(2)Message terminator

Upon reception of <NL> (message terminator), the current path is set to the root.

(3)Colon (command separator)

When a colon is placed between two keywords, the colon moves the current path down one level in the command tree.

(4)Colon (root specifier)

When a colon is placed at the beginning of a command, the colon sets the current path to the root.

(5)Semicolon

Semicolons do not affect to the current path.

(6)Space

Spaces do not affect to the current path.

(7)Comma

Commas do not affect to the current path.

(8)IEEE488.2 common command

Common commands do not affect to the current path.

By using semicolons properly, multiple commands can be sent efficiently.

For example,

:SOURce:VOLTage:LEVel:IMMediate:AMPLitude 1.0; OFFSet 1.0<NL><^END>

is the same as sending the following two commands:

:SOURce:VOLTage:LEVel:IMMediate:AMPLitude 1.0<NL><^END>
:SOURce:VOLTage:LEVel:IMMediate:OFFSet 1.0<NL><^END>

When an optional keyword is omitted, you should pay careful attention to the current path movement.

For example,

:VOLTage 1.0<NL><^END>

sets the current path to ":SOURce."

If you want to send the following two program messages as one program message,

:SOURce:VOLTage:LEVel:IMMediate:AMPLitude 1.0<NL><^END>
:SOURce:FREQuency:FIXed 100.0<NL><^END>

<Program message which is executed properly>
:SOURce:VOLTage 1.0; FREQuency:FIXed 100.0<NL><^END>

<Program message which causes parsing error>
:SOURce:VOLTage:LEVel:IMMediate:AMPLitude1.0; FREQuency:FIXed 100.0<NL><^END>

Here, the current path of the second command is ":SOURce:VOLTage:LEVel:IMMediate" (by right, it must be ":SOURce"). Therefore, ":FREQuency:FIXed 100.0" causes parsing error.

3.1.7 Elements of SCPI Commands

3.1.7.1 Common Command Syntax

The syntax of common commands is shown in Figure 3.2. In this figure, a keyword consists of three alphanumeric characters, beginning with an alphabetic character.

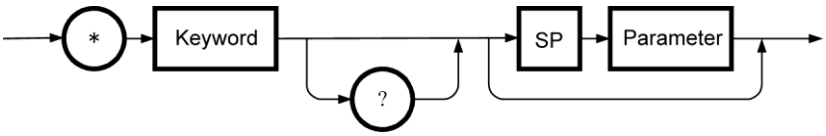


Figure 3.2 Common Command Syntax

"SP" in Figure 3.2 is technically as shown in Figure 3.3 (hereinafter, all SP means the same).

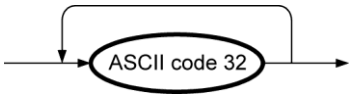


Figure 3.3 SP Syntax

3.1.7.2 Subsystem Command Syntax

The syntax of the subsystem commands is shown in Figure 3.4.

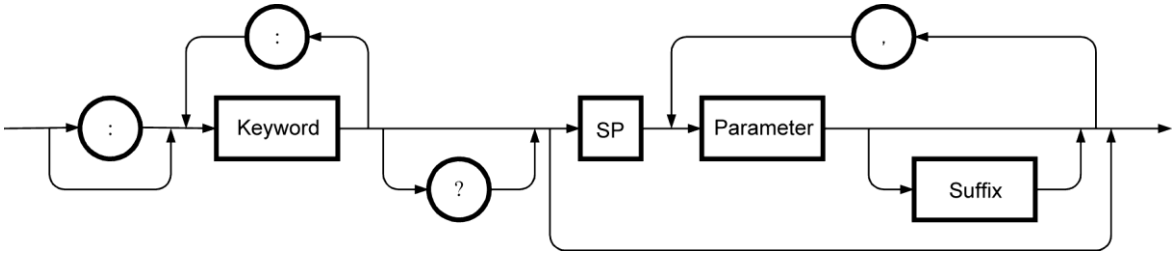


Figure 3.4 Subsystem Command Syntax

3.1.7.3 Keyword

The keyword in the command syntax is a string of up to 12 characters consisting of uppercase and lowercase alphabetic characters, underscore (_), and numeric characters, beginning with an alphabetic character.

Most keywords are shown as a mixture of uppercase and lowercase characters.

The uppercase characters represent the short form for commands. Either long or short form format can be accepted; commands are not case sensitive actually.

Examples for the keyword "OUTPut" are listed in Table 3.2.

Table 3.2 Acceptable and Unacceptable Keywords (for "OUTPut")

Keyword	Description
OUTPUT	Accepted as long form.
OUTP	Accepted as short form.
OuTpUt	Accepted as long form without distinguishing uppercase and lowercase characters.
oUtP	Accepted as short form without distinguishing uppercase and lowercase characters.
OUTPU	Not accepted because it corresponds to neither long form nor short form.
OUT	Not accepted because it corresponds to neither long form nor short form.

3.1.7.4 Keyword Separator

Keyword separators serve to separate the current keyword and the next lower-level keyword as shown in the example below. Colons (:) are used as keyword separators.

```
:OUTPut:STATe?
```

3.1.7.5 Root Specifier

A colon (:) at the beginning of the subsystem command serves as a root specifier.

The root specifier sets the current path to the root.

As colons (:) are also used as command separators, you need to carefully use them depending on your purpose.

```
SOURce:FREQuency:FIXed 100.0
                    → All colons are header separators
:SOURce:FREQuency:FIXed 1.0
                    → The first colon is the root specifier
SOURce:FREQuency:FIXed 100.0; :OUTPut ON
                    → The third colon is the root specifier
```

3.1.7.6 Optional Keywords

The keywords enclosed in square brackets ([]) are optional, and can be omitted. However, the square brackets ([]) are used for description purpose only, and are not included in the actual command to be sent.

If the keyword is omitted, the command parser interprets the command as if that optional keyword is received.

For example,

:OUTPut[:STATe]

means that you can use either of the following commands:

:OUTPut:STATe
:OUTPut

3.1.7.7 Implied Channels (Optional Numeric Keyword Suffix)

Many commands allow you to specify channels by using an optional numeric keyword suffix.
For example,

:OUTPut[1|2]:STATe {ON|OFF}

means commands for channel 1 and 2 as follows:

:OUTPut[1]:STATe {ON|OFF}
:OUTPut2:STATe {ON|OFF}

Here, you need to note that if you do not specify the channel number, the channel 1 will be selected as an implied channel.
For example, to control the channel 1 output to be turned ON, you can use either of the following commands.

:OUTPut1:STATe ON
:OUTPut:STATe ON

3.1.7.8 Parameter Type

In the command list, the angle brackets (<>) indicate parameters. The parameter type is one of the following types.

Numeric parameter (<REAL>, <INT>)

The syntax of numeric parameters is shown in Figure 3.5.

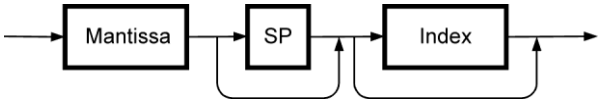


Figure 3.5 Numeric Parameter (<REAL>, <INT>) Syntax

The syntaxes of the mantissa and index in Figure 3.5 are shown in Figure 3.6 and Figure 3.7.

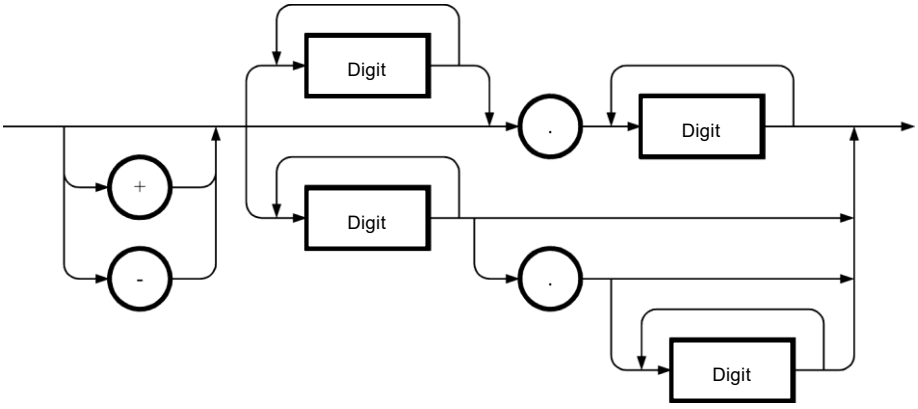


Figure 3.6 Mantissa Syntax

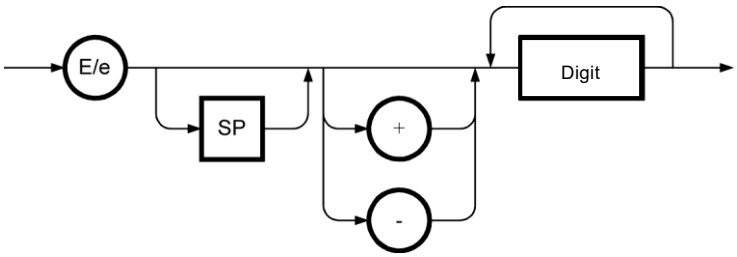


Figure 3.7 Index Syntax

3.1.7.9 Discrete Parameter (<DISC>)

The syntax of the discrete parameter is shown in Figure 3.8.

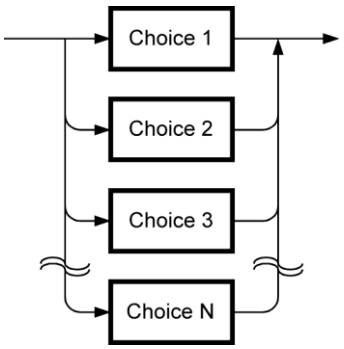


Figure 3.8 Discrete Parameter (<DISC>) Syntax

3.1.7.10 Boolean Value Parameter (<BOL>)

The syntax of the Boolean value parameter is shown in Figure 3.9.

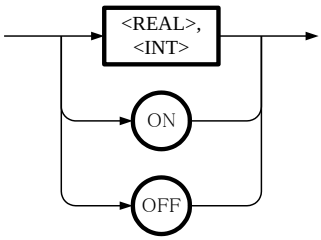


Figure 3.9 Boolean Value Parameter (<BOL>) Syntax

The boolean parameter is interpreted the values other than 0 as true, and 0 as false.

If the specified value includes a fractional part, that value is interpreted as the whole number obtained by rounding the fractional part. Therefore, "0.4" is false (rounded off to 0), and "0.5" is true (rounded off to 1).

3.1.7.11 String Program Data (<STR>)

The syntax of the string program data is shown in Figure 3.10.

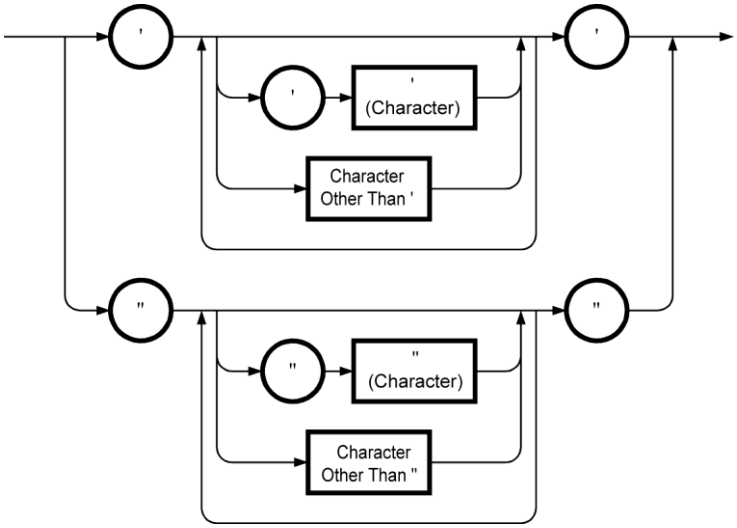


Figure 3.10 String Parameter (<STR>) Syntax

In the KP2000AS, you cannot use the following nine characters as a part of a string: \, /, :, *, ?, “, <, >, |. If the string includes one of these characters, an error process will be raised.(The error message returns an error code :-150 "String data error.")

3.1.7.12 Block Program Data (<BLK>)

The syntax of the block program data is shown in Figure 3.11.

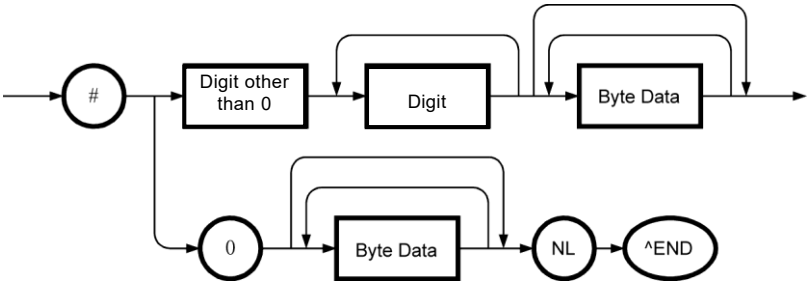


Figure 3.11 Block Program Data (<BLK>) Syntax

For the definite length block program data, if "^END" is received before receiving the specified number of bytes, it is treated as a command error.

The KP2000AS only accept the definite length block program data, and the number string between # and the first byte data is fixed to 48192. The byte data must be 8192 bytes.

3.1.7.13 Parameter Separator

If you want to send multiple parameters in one command, you need to separate the adjacent parameters with a comma (,).

3.1.7.14 Query Parameter

Most of the queries supported by the commands that have decimal numeric parameters can return the minimum or maximum values if "MINimum" or "MAXimum" is specified after "?".
For example, to query the minimum and maximum values of the frequency, send the following queries:

```
:SOURce:FREQuency? MINimum
:SOURce:FREQuency? MAXimum
```

3.1.7.15 Suffix

The syntax of suffix is shown in Figure 3.12.

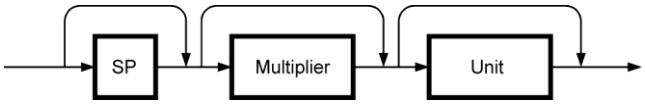


Figure 3.12 Suffix Syntax

3.1.7.16 Command Terminator

A command terminator is either <NL> (ASCII character decimal 10), an EOI (End-of Identify) asserted by the last byte, or an EOI asserted by <NL>.

Using multiple commands

Program message

A program message is a combination of one or more IEEE488.2 common commands and SCPI commands, and used to send multiple commands at once.

Program Message Syntax

The syntax of the program message is shown in Figure 3.13.

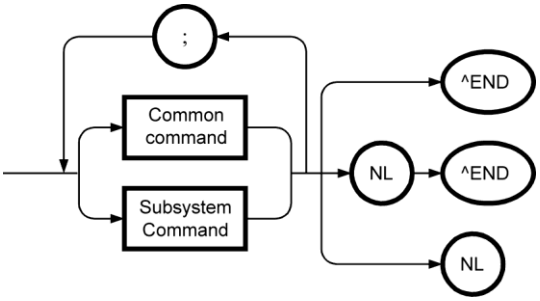


Figure 3.13 Program Message Syntax

3.1.8 Overview of Response Message Formats

3.1.8.1 Response Message

The response data that can be read from the KP2000AS when the command is sent by the computer to inquire something is called "response message." The command sent by the computer is called "query", and a question mark (?) is placed at the end of the command.

3.1.8.2 Response Message Syntax

The syntax of the response message is shown in Figure 3.14.

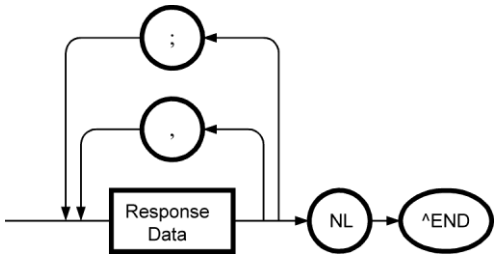


Figure 3.14 Response Message Syntax

In response messages, commas (,) and semicolons (;) are used as separators. When multiple values are returned by one command, data items are separated by commas (,).
When multiple queries are sent in the same message, the data item groups for each query are separated by semicolons (;).

3.1.8.3 Response Message Data Type

The data type of the response message is one of the followings:

Real number response data syntax (<REAL>)

The syntax of the real number response data is shown in Figure 3.15.

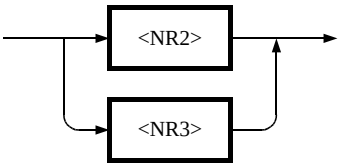


Figure 3.15 Real Number Response Data (<REAL>) Syntax

The syntax of the NR2 number response data is shown in Figure 3.16.

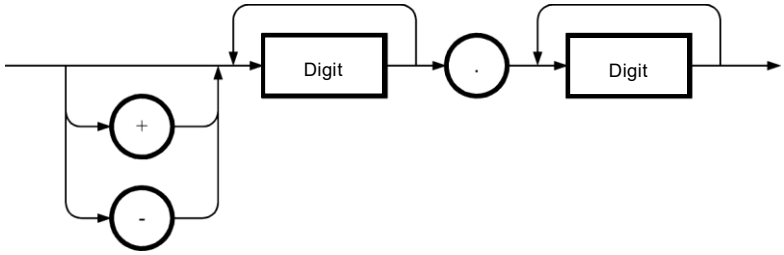


Figure 3.16 NR2 Number Response Data (<NR2>) Syntax

The syntax of the NR3 number response data is shown in Figure 3.17.

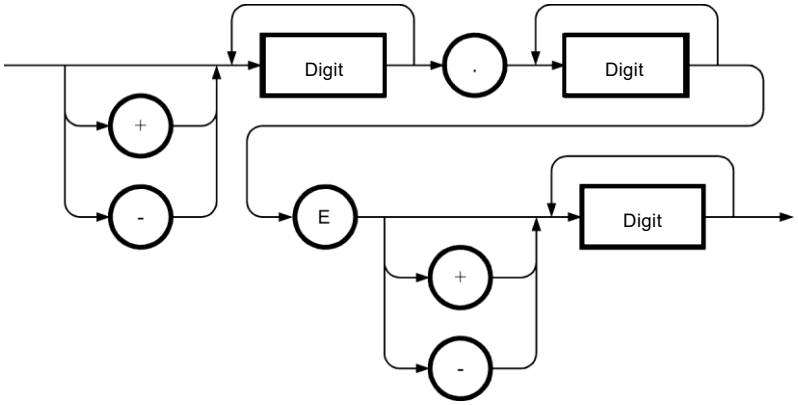


Figure 3.17 NR3 Number Response Data (<NR3>) Syntax

Integer response data (<INT>)

The syntax of the integer response data is shown in Figure 3.18. The integer response data syntax is same as that of the NR1 number response data defined in IEEE488.2.

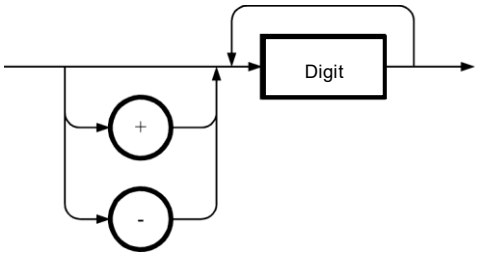


Figure 3.18 Integer Response Data (<INT>) Syntax

Discrete response data (<DISC>)

The syntax of the discrete response data is shown in Figure 3.19.

The response data is always in short form.

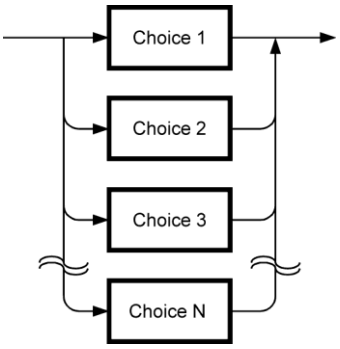


Figure 3.19 Discrete Response Data (<DISC>) Syntax

Numeric Boolean value response data (<NBOL>)

The syntax of the numeric Boolean value response data is shown in Figure 3.20.

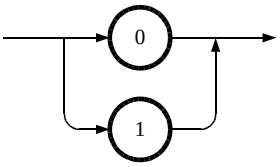


Figure 3.20 Numeric Boolean Value Response Data (<NBOL>) Syntax

String response data (<STR>)

The syntax of the string response data is shown in Figure 3.21.

Note that double quotation (”) is never contained in a response string in the KP2000AS.

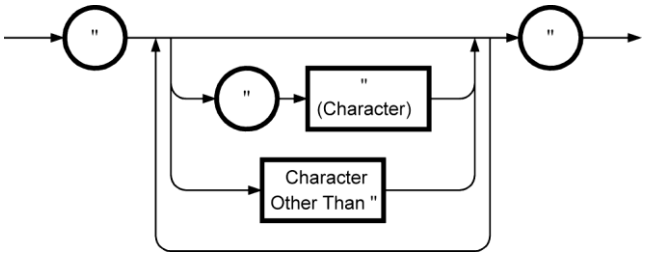


Figure 3.21 String Response Data (<STR>) Syntax

Definite length arbitrary block response data (<DBLK>)

The syntax of the definite length arbitrary block response data is shown in Figure 3.22.
However, the KP2000AS does not return this type of response message.

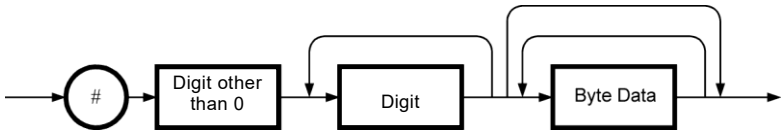


Figure 3.22 Definite Length Arbitrary Block Response Data Syntax (<DBLK>)

Indefinite length arbitrary block response data (<IBLK>)

The syntax of the indefinite length arbitrary block response data is shown in Figure 3.23.
However, the KP2000AS does not return this type of response message.

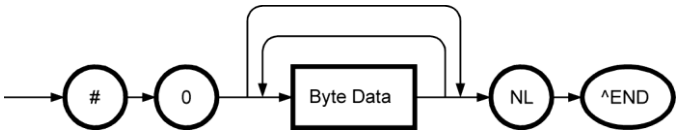


Figure 3.23 Indefinite Length Arbitrary Block Response Data Syntax (<IBLK>)

4.Remote Command Reference

4.1 Program Command List

This chapter describes the program commands for the KP2000AS.

Some commands may be given permission or inhibition of acceptance for each output function. Some other commands may be handled as a command error or may not be accepted, to maintain the integrity of the internal operation state of the KP2000AS. In addition, some commands may not be run depending on the output phase mode supported by the purchased product.

For these commands that require special attentions, tips are described to run them properly in "Program Command Description".

4.1.1 List of Commands Common to Functions

Function	Command	Set	Query
Common Command (IEEE488.2)			
Device ID	*IDN?	—	○
Initialize the basic setting	*RST	○	—
Self-Check	*TST?	—	○
Clear event register and error queue	*CLS	○	—
Set/get the standard event status enable register	*ESE	○	○
Get the standard event status register	*ESR?	—	○
Set/get the service request enable register	*SRE	○	○
Get the status byte register	*STB?	—	○
Wait for synchronization of the overlap command	*WAI	○	—
Set the OPC bit at the operation completion	*OPC	○	—
Get the operation completion state	*OPC?	—	○
Operate System Lock Condition Register			
Get the System Lock condition register	:STATus:LOCK:CONDition?	—	○
Set/get the System Lock event enable register	:STATus:LOCK:ENABle	○	○
Get the System Lock event register	:STATus:LOCK[:EVENt]?	—	○
Set/get the System Lock transition filter (negative)	:STATus:LOCK:NTRansition	○	○
Set/get the System Lock transition filter (positive)	:STATus:LOCK:PTRansition	○	○

Operate Operation Condition Register			
Operation condition register	:STATus:OPERation:CONDition?	—	○
Operation event enable register	:STATus:OPERation:ENABle	○	○
Operation event register	:STATus:OPERation[:EVENt]?	—	○
Operation transition filter (negative)	:STATus:OPERation:NTRansition	○	○
Operation transition filter (positive)	:STATus:OPERation:PTRansition	○	○
Get Error Message			
Get error messages	:SYSTem:ERRor?	—	○
Get Power On Error Message			
Get Power on error messages	:SYSTem:MESSage?	—	○
Operate Warning Condition Register			
Get the warning condition register	:STATus:WARNing:CONDition?	—	○
Set/get the warning event enable register	:STATus:WARNing:ENABle	○	○
Get the warning event register	:STATus:WARNing[:EVENt]?	—	○
Set/get the warning transition filter (negative)	:STATus:WARNing:NTRansition	○	○
Set/get the warning transition filter (positive)	:STATus:WARNing:PTRansition	○	○
Release the warning	:SYSTem:WRELease	○	—
Output Control			
Set/get the output on/off	:OUTPut[:STATe]	○	○
Set/get the output at power-on	:OUTPut:PON	○	○
Set/get the output relay control	:OUTPut:RELay	○	○
Set/get the high impedance output off	:OUTPut:OFFImpedance	○	○
Set Panel Display Operation			
Set/get the LCD BRIGhtness value	:DISPlay:CONTrast | BRIGhtness	○	○
Set/get the Key lock	:SYSTem:KLOCk	○	○

Operation Beep	:SYSTem:BEEPer:STATe	○	○
Limiter Beep	:SYSTem:BEEPer:LIMit:STATe	○	○
Get Power Unit State			
Get the number of connected unit	:SYSTem:CONFigure:NPU[:STATe]?	—	○
Get the error status	:SYSTem:CONFigure:NPU:ERRor?	—	○
Set Monitor Output			
Set/get the monitor output	:OUTPut:MONitor:MODE	○	○
Current Limiter			
Set/get the current limiter (effective value)	[:SOURce]:CURRent:LIMit:RMS[:AMPLitude]	○	○
Set/get off after the current limiter (effective value) is activated	[:SOURce]:CURRent:LIMit:RMS:MODE	○	○
Set/get the time before turning off after the current limiter (effective value) is activated	[:SOURce]:CURRent:LIMit:RMS:TIME	○	○
Set/get the current limiter (peak value <maximum>)	[:SOURce]:CURRent:LIMit:PEAK:HIGH	○	○
Set/get the current limiter (peak value <minimum>)	[:SOURce]:CURRent:LIMit:PEAK:LOW	○	○
Set/get off after the current limiter (peak value) is activated	[:SOURce]:CURRent:LIMit:PEAK:MODE	○	○
Set/get the time before turning off after the current limit (peak value) is activated	[:SOURce]:CURRent:LIMit:PEAK:TIME	○	○
Output Setting (for All Phases)			
Set/get the output range(CV)*1	[:SOURce]:VOLTage:RANGe	○	○
Set/get the AC/DC mode*1	[:SOURce]:MODE	○	○
CLIP Waveform Setting			
Set/get the clipped sine wave type specification	[:SOURce]:FUNCtion:CSINe:TYPE	○	○

Set/get the clipped sine wave crest factor	[:SOURce]:FUNCtion:CSINe:CFACtor	○	○
Set/get the clipped sine wave clip ratio	[:SOURce]:FUNCtion:CSINe:CLIP	○	○
Factory Setting			
Execute factory set	:SYSTem:INIT	○	—
Date and Time Settings			
Set/get Date and Time	:SYSTem:DATE	○	○

*1 The setting is held by each output function.
After the output function is switched, the setting held by the new output function is forcibly used.

4.1.2 List of Continuous Function Commands

Function	Command	Set	Query
Common Command (IEEE488.2)			
Read the basic setting data	*RCL	○	—
Save the basic setting data	*SAV	○	—
Set Panel Display			
Set/get the measurement display selection	:DISPlay[:WINDow]:MEASure:MODE	○	○
Output Setting (for All Phases)			
Set/get the output frequency	[:SOURce]:FREQuency[:IMMediate]	○	○
Set the output on phase	[:SOURce]:PHASe:STARt[:IMMediate]	○	○
Enable/disable the output off phase specification	[:SOURce]:PHASe:STOP:ENABle	○	○
Set the output off phase	[:SOURce]:PHASe:STOP[:IMMediate]	○	○
Set/get the remote sensing function	:MEASure:CONFigure:SENSing	○	○
Output Setting (for Specific Phase)			
Set/get the AC output voltage	[:SOURce]:VOLTage[:LEVel][:IMMediate][:AMPLitude]	○	○
Set/get the DC output voltage	[:SOURce]:VOLTage[:LEVel][:IMMediate]:OFFSet	○	○
Set/get the output waveform	[:SOURce]:FUNCtion[:SHAPe][:IMMediate]	○	○
Set/get the DC offset voltage adjustment value (AC mode)	[:SOURce]:VOLTage:ADJust:OFFSet:AC	○	○
Set/get the DC offset voltage adjustment value (ACDC and DC modes)	[:SOURce]:VOLTage:ADJust:OFFSet:DC	○	○
Voltage Setting Limit			
Set/get the voltage setting limit (effective value)	[:SOURce]:VOLTage:LIMit:RMS	○	○
Set/get the voltage setting limit (peak value <maximum>)	[:SOURce]:VOLTage:LIMit:HIGH	○	○
Set/get the voltage setting limit (peak value <minimum>)	[:SOURce]:VOLTage:LIMit:LOW	○	○
Frequency Setting Range Limit			
Set/get the upper limit value of the frequency setting range limit	[:SOURce]:FREQuency:LIMit:HIGH	○	○

Set/get the lower limit value of the frequency setting range limit	[:SOURce]:FREQuency:LIMit:LOW	○	○
Get Output Measured Value			
Clear the output current peak-hold value	:MEASure[:SCALar]:CURRent:PEAK:CLEar	○	—
Output current peak-hold value	:MEASure[:SCALar]:CURRent:PEAK:HOLD?	—	○
Clear the output voltage peak-hold value	:MEASure[:SCALar]:VOLTage:PEAK:CLEar	○	—
Output voltage peak-hold value	:MEASure[:SCALar]:VOLTage:PEAK:HOLD?	—	○
Synchronization signal source frequency	:MEASure[:SCALar]:FREQuency?	—	○
Output voltage (effective value)	:MEASure[:SCALar]:VOLTage[:RMS]?	—	○
Output voltage (average value)	:MEASure[:SCALar]:VOLTage:AVErage?	—	○
Output voltage (peak value <maximum>)	:MEASure[:SCALar]:VOLTage:HIGH?	—	○
Output voltage (peak value <minimum>)	:MEASure[:SCALar]:VOLTage:LOW?	—	○
Output voltage crest factor	:MEASure[:SCALar]:VOLTage:CFACtor?	—	○
Output current (effective value)	:MEASure[:SCALar]:CURRent[:RMS]?	—	○
Output current (average value)	:MEASure[:SCALar]:CURRent:AVErage?	—	○
Output current (peak value <maximum>)	:MEASure[:SCALar]:CURRent:HIGH?	—	○
Output current (peak value <minimum>)	:MEASure[:SCALar]:CURRent:LOW?	—	○
Set/get harmonic measurement type	:MEASure[:SCALar]:HARMonic:TYPE	○	○
Harmonic voltage value	:MEASure[:SCALar]:VOLTage:HARMonic[:RMS]?	—	○
Harmonic voltage percentage	:MEASure[:SCALar]:VOLTage:HARMonic:RATio?	—	○
Set/get Control the harmonic current measurement function	:MEASure[:SCALar]:CURRent:HARMonic:ENABle	○	○
Harmonic current value	:MEASure[:SCALar]:CURRent:HARMonic[:RMS]?	—	○
Harmonic current percentage	:MEASure[:SCALar]:CURRent:HARMonic:RATio?	—	○
Output current crest factor	:MEASure[:SCALar]:CURRent:CFACtor?	—	○
Apparent power	:MEASure[:SCALar]:POWer[:AC]:APParent?	—	○
Power factor	:MEASure[:SCALar]:POWer[:AC]:PFACtor?	—	○
Active power	:MEASure[:SCALar]:POWer[:AC][:REAL]?	—	○
AGC/Autocal Function Setting			
Enable/disable the AGC function	:OUTPut:AGC	○	○

Enable/disable the Autocal function	:OUTPut:ACALibration	○	○
Set External Input Signal			
Set/get the external input gain	:INPut:GAIN	○	○
Set/get the external synchronization signal source	:INPut:SYNC:SOURce	○	○
Set External Control Signal			
Permit/inhibit the external control input	:SYSTem:CONFigure:EXTio[:STATe]	○	○
Set/get the external control state output polarity	:SYSTem:CONFigure:EXTio:POLarity	○	○
Set Soft Start / Soft Stop			
Enable/disable soft start function	:OUTPut:SSTart[:STATe][:RISE]	○	○
Set/get soft start time	:OUTPut:SSTart:TIME[:RISE]	○	○
Enable/disable soft stop function	:OUTPut:SSTart[:STATe]:FALL	○	○
Set/get soft stop time	:OUTPut:SSTart:TIME:FALL	○	○

4.1.3 List of EPO Commands

Function	Command	Set	Query
Set/get the output on/off	OUT	○	○
Set/get precision mode or high stability mode	PRC	○	○
Set/get the AC/DC voltage mode	DCM	○	○
Set/get the output AC range or DC range	RNG	○	○
Set/get the start phase	SPH	○	○
Set/get the frequency	FRQ	○	○
Set/get the upper limit value of the frequency setting range limit	FUP	○	○
Set/get the lower limit value of the frequency setting range limit	FLW	○	○
Set/Get AC or DC output voltage	VLT	○	○
Set/get the AC or DC voltage setting limit	VUP	○	○

4.2 Program Command Description

4.2.1 Commands Common to Functions

4.2.1.1 Common Command (IEEE488.2): Device ID

*IDN?

Description

Gets the device ID

Query parameter

None

Response format

<STR>

Query example

*IDN?

Response example

NF Corporation,KP2000AS,1234567,1.00

4.2.1.2 Common Command (IEEE488.2): Initialize Basic Setting

*RST

Description

Initializes the setting

Setting parameter

None

Setting example

*RST

Remarks

The operation cannot be done during the output on.

4.2.1.3 Common Command (IEEE488.2): Self-Check

*TST?

Description

Gets the self-check result

For the KP2000AS, it always returns 0 without performing the self-check

Query parameter

None

Response format

<INT>

Query example

*TST?

Response example

0

4.2.1.4 Common Command (IEEE488.2): Clear Event Register and Error Queue

*CLS

Description

Clears event register and error queue

For the event register, see *2.2.2*, *2.2.4.1*, *2.2.5.3*, *2.2.6.3*, and *2.2.7.3*

Setting parameter

None

Setting example

*CLS

4.2.1.5 Common Command (IEEE488.2): Set/Get Standard Event Status Enable Register

*ESE

Description

Sets/Gets the standard event status enable register

For the standard event status enable register, see *2.2.4.2*

Setting parameter

<value> ::= <INT>

<INT> → Register setting value: 0 to 255

Query parameter

None

Response format

<INT>

Setting example

*ESE 8

Query example

*ESE?

Response example

8

4.2.1.6 Common Command (IEEE488.2): Get Standard Event Status Register

*ESR?

Description

Gets the standard event status register

For the standard event status register, see 2.2.4.1

Query parameter

None

Response format

<INT>

Query example

*ESR?

Response example

8

4.2.1.7 Common Command (IEEE488.2): Set/Get Service Request Enable Register

*SRE

Description

Sets/gets the service request enable register

For the service request enable register, see *2.2.3*

Setting parameter

<value> ::= <INT>

<INT> → Register setting value: 0 to 255

Query parameter

None

Response format

<INT>

Setting example

*SRE 8

Query example

*SRE?

Response example

8

4.2.1.8 Common Command (IEEE488.2): Get Status Byte Register

*STB?

Description

Gets the status byte register

For the status byte register, see 2.2.2

Query parameter

None

Response format

<INT>

Query example

*STB?

Response example

8

4.2.1.9 Common Command (IEEE488.2): Wait for Synchronization of Overlap Command

*WAI

Description

Waits for completion of all the previous commands.

KP2000AS does not have overlap command.

Setting parameter

None

Setting example

*WAI

4.2.1.10 Common Command (IEEE488.2): Set OPC Bit at Operation Completion

*OPC

Description

Sets the OPC bit to 1 when all the previous commands are completed

KP2000AS does not have overlap command

For the OPC bit, see 2.2.4.1

Setting parameter

None

Setting example

*OPC

4.2.1.11 Common Command (IEEE488.2): Get Operation Completion State

*OPC?

Description

Sets the output buffer to 1 when all the previous commands are completed

KP2000AS does not have overlap command

Query parameter

None

Response format

<INT>

Query example

*OPC?

Response example

1

4.2.1.12 Operate System Lock Condition Register: System Lock Condition Register

:STATus:LOCK:CONDition?

Description

Gets the System Lock condition register

For the System Lock condition register, see ***2.2.7.1***

Query parameter

None

Response format

<INT>

Query example

STAT:LOCK:COND?

Response example

1

4.2.1.13 Operate System Lock Condition Register: System Lock Event Enable Register

:STATus:LOCK:ENABLe

Description

Sets/gets the System Lock event enable register

For the System Lock event enable register, see ***2.2.7.4***

Setting parameter

<value> ::= <INT>

<INT> → Register setting value: 0 to 65535

Query parameter

None

Response format

<INT>

Setting example

STAT:LOCK:ENAB 1

Query example

STAT:LOCK:ENAB?

Response example

1

4.2.1.14 Operate System Lock Condition Register: System Lock Event Register

:STATus:LOCK[:EVENt]?

Description

Gets the System Lock event register

For the System Lock event register, see *2.2.7.3*

Query parameter

None

Response format

<INT>

Query example

STAT:LOCK?

Response example

16384

4.2.1.15 Operate System Lock Condition Register: System Lock Transition Filter (Negative)

:STATus:LOCK:NTRansition

Description

Sets/gets the System Lock transition filter (negative)

For the System Lock transition filter, see 2.2.7.2

Setting parameter

<value> ::= <INT>

<INT> → Register setting value: 0 to 65535

Query parameter

None

Response format

<INT>

Setting example

STAT:LOCK:NTR 16384

Query example

STAT:LOCK:NTR?

Response example

16384

4.2.1.16 Operate System Lock Condition Register: System Lock Transition Filter (Positive)

:STATus:LOCK:PTRansition

Description

Sets/gets the System Lock transition filter (positive)

For the System Lock transition filter, see 2.2.7.2

Setting parameter

<value> ::= <INT>

<INT> → Register setting value: 0 to 65535

Query parameter

None

Response format

<INT>

Setting example

STAT:LOCK:PTR 16384

Query example

STAT:LOCK:PTR?

Response example

16384

4.2.1.17 Operate Operation Condition Register: Operation Condition Register

:STATus:OPERation:CONDition?

Description

Gets the operation condition register

For the operation condition register, see *2.2.5.1*

Query parameter

None

Response format

<INT>

Query example

STAT:OPER:COND?

Response example

16384

4.2.1.18 Operate Operation Condition Register: Operation Event Enable Register

:STATus:OPERation:ENABle

Description

Sets/gets the operation event enable register

For the operation event enable register, see *2.2.5.4*

Setting parameter

<value> ::= <INT>

<INT> → Register setting value: 0 to 65535

Query parameter

None

Response format

<INT>

Setting example

STAT:OPER:ENAB 16384

Query example

STAT:OPER:ENAB?

Response example

16384

4.2.1.19 Operate Operation Condition Register: Operation Event Register

:STATus:OPERation[:EVENt]?

Description

Gets the operation event register

For the operation event register, see *2.2.5.3*

Query parameter

None

Response format

<INT>

Query example

STAT:OPER?

Response example

16384

4.2.1.20 Operate Operation Condition Register: Operation Transition Filter (Negative)

:STATus:OPERation:NTRansition

Description

Sets/gets the operation transition filter (negative)

For the operation transition filter, see *2.2.5.2*

Setting parameter

<value> ::= <INT>

<INT> → Register setting value: 0 to 65535

Query parameter

None

Response format

<INT>

Setting example

STAT:OPER:NTR 16384

Query example

STAT:OPER:NTR?

Response example

16384

4.2.1.21 Operate Operation Condition Register: Operation Transition Filter (Positive)

:STATus:OPERation:PTRansition

Description

Sets/gets the operation transition filter (positive)

For the operation transition filter, see 2.2.5.2

Setting parameter

<value> ::= <INT>

<INT> → Register setting value: 0 to 65535

Query parameter

None

Response format

<INT>

Setting example

STAT:OPER:PTR 16384

Query example

STAT:OPER:PTR?

Response example

16384

4.2.1.22 Get Error Message: Get Error Message

:SYSTem:ERRor?

Description

Gets the error queue output

It returns the error ID and the error message in the order

Query parameter

None

Response format

<INT>,<STR>

Query example

SYST:ERR?

Response example

0,"No error"

4.2.1.23 Get Error Message: Get Error Message

:SYSTem:MESSage?

Description

Get error message at startup

When "Press enter key" appears on the screen, this command replaces the Enter key.

for example, after setting the phase configuration.

Query parameter

None

Response format

<INT>,<STR>

Query example

SYST:MESS?

Response example

0,"No error"

4.2.1.24 Operate Warning Condition Register: Get Warning Condition Register

:STATus:WARNing:CONDition?

Description

Gets the warning condition register

For the warning condition register, see *2.2.6.1*

Query parameter

None

Response format

<INT>

Query example

STAT:WARN:COND?

Response example

16384

4.2.1.25 Operate Warning Condition Register: Set/Get Warning Event Enable Register

:STATus:WARNing:ENABle

Description

Sets/gets the warning event enable register

For the warning event enable register, see *2.2.6.4*

Setting parameter

<value> ::= <INT>

<INT> → Register setting value: 0 to 65535

Query parameter

None

Response format

<INT>

Setting example

STAT:WARN:ENAB 16384

Query example

STAT:WARN:ENAB?

Response example

16384

4.2.1.26 Operate Warning Condition Register: Get Warning Event Register

:STATus:WARNing[:EVENt]?

Description

Gets the warning event register

For the warning event register, see 2.2.6.3

Query parameter

None

Response format

<INT>

Query example

STAT:WARN?

Response example

16384

4.2.1.27 Operate Warning Condition Register: Set/Get Warning Transition Filter (Negative)

:STATus:WARNing:NTRansition

Description

Sets/gets the warning transition filter (negative)

For the warning transition filter, see ***2.2.6.2***

Setting parameter

<value> ::= <INT>

<INT> → Register setting value: 0 to 65535

Query parameter

None

Response format

<INT>

Setting example

STAT:WARN:NTR 16384

Query example

STAT:WARN:NTR?

Response example

16384

4.2.1.28 Operate Warning Condition Register: Set/Get Warning Transition Filter (Positive)

:STATus:WARNing:PTRansition

Description

Sets/gets the warning transition filter (positive)

For the warning transition filter, see 2.2.6.2

Setting parameter

<value> ::= <INT>

<INT> → Register setting value: 0 to 65535

Query parameter

None

Response format

<INT>

Setting example

STAT:WARN:PTR 16384

Query example

STAT:WARN:PTR?

Response example

16384

4.2.1.29 Operate Warning Condition Register: Release Warning

:SYSTem:WRELease

Description

Sets the release of the warning

Setting parameter

None

Setting example

SYST:WREL

Remarks

The setting is error during the System Lock.

4.2.1.30 Output Control: Set/Get Output On/Off

:OUTPut[:STATe]

Description

Sets/gets the output on/off

Setting parameter

<state> ::= <BOL>

<BOL> → 0/OFF: Disable, 1/ON: Enable

Query parameter

None

Response format

<NBOL>

Setting example

OUTP ON

Query example

OUTP?

Response example

1

Remarks

The setting is error during the System Lock/warning.

4.2.1.31 Output Control: Set/Get Output at Power-On

:OUTPut:PON

Description

Sets/gets the output at power-on

Setting parameter

<state> ::= <BOL>

<BOL> → 0/OFF: Disable, 1/ON: Enable

Query parameter

None

Response format

<NBOL>

Setting example

OUTP:PON ON

Query example

OUTP:PON?

Response example

1

Remarks

The setting is error during the System Lock/warning.

4.2.1.32 Output Control: Set/Get Output Relay Control

:OUTPut:RELay

Description

Sets/gets the output relay control

Setting parameter

<state> ::= <BOL>

<BOL> → 0/OFF: Disable, 1/ON: Enable

Query parameter

None

Response format

<NBOL>

Setting example

OUTP:REL ON

Query example

OUTP:REL?

Response example

1

Remarks

The setting is error during the System Lock/warning.

4.2.1.33 Output Control: Set/Get High Impedance Output Off

:OUTPut:OFFImpedance

Description

Sets/gets high impedance output off function

Setting parameter

<state> ::= <BOL>

<BOL> → 0/OFF: Disable, 1/ON: Enable

Query parameter

None

Response format

<NBOL>

Setting example

OUTP:OFFI ON

Query example

OUTP:OFFI?

Response example

1

Remarks

The setting is error during the System Lock/warning.

4.2.1.34 Set Panel Display Operation: Set/Get LCD brightness value

:DISPlay:CONTrast | BRIGhtness

Description

Sets/gets the LCD brightness

Setting parameter

<contrast> | MINimum | MAXimum

<contrast> ::= <INT>

<INT> → LCD brightness: 0 to 99

MINimum → 0

MAXimum → 99

Query parameter

[MINimum | MAXimum]

MINimum → Gets the minimum value

MAXimum → Gets the maximum value

Response format

<INT>

Setting example

DISP:CONT 55

Query example

DISP:CONT?

Response example

55

4.2.1.35 Set Panel Display Operation: Set/Get Key Lock

:SYSTem:KLOCk

Description

Sets/gets the key lock

Setting parameter

<state> ::= <BOL>

<BOL> → 0/OFF: Disable, 1/ON: Enable

Query parameter

None

Response format

<NBOL>

Setting example

SYST:KLOC ON

Query example

SYST:KLOC?

Response example

1

4.2.1.36 Set Panel Display Operation: Set/Get Operation Beep

:SYSTem:BEEPer:STATe

Description

Sets/gets the operation beep

Setting parameter

<state> ::= <BOL>

<BOL> → 0/OFF: Disable, 1/ON: Enable

Query parameter

None

Response format

<NBOL>

Setting example

SYST:BEEP:STAT ON

Query example

SYST:BEEP:STAT?

Response example

1

Remarks

The setting is error during the System Lock/warning.

4.2.1.37 Set Panel Display Operation: Set/Get Limiter Beep

:SYSTem:BEEPer:LIMit:STATe

Description

Sets/gets the limiter beep

Setting parameter

<state> ::= <BOL>

<BOL> → 0/OFF: Disable, 1/ON: Enable

Query parameter

None

Response format

<NBOL>

Setting example

SYST:BEEP:LIM:STAT ON

Query example

SYST:BEEP:LIM:STAT?

Response example

1

Remarks

The setting is error during the System Lock/warning.

4.2.1.38 Get State of Power Unit: Get Number of Connected Power Units

:SYSTem:CONFigure:NPU[:STATe]?

Description

Obtain the connection configuration.

The status of each phase is assigned to each bit as follows.

Bit	Weight	Description
1	2	Booster 1
0	1	Phase Master

Query parameter

None

Response format

<INT>,0,0

The second and third data items always return 0.

Query example

SYST:CONF:NPU?

Response example

3,0,0

(shows that phase master/booster 1 is connected.)

4.2.1.39 Get State of Power Unit: Get Error State

:SYSTem:CONFigure:NPU:ERRor?

Description

Gets the power unit in which an error occurs

The status of each phase is assigned for each bit as follows:

If an error occurs in a power unit, the corresponding bit returns 1.

Bit	Weight	Description
1	2	Booster 1
0	1	Phase Master

Query parameter

None

Response format

<INT>,0,0

The second and third data items always return 0.

Query example

SYST:CONF:NPU:ERR?

Response example

2,0,0

(shows that booster 1 is error.)

4.2.1.40 Set Monitor Output: Set/Get Monitor Output

:OUTPut:MONitor:MODE

Description

Sets/gets the monitor output

Setting parameter

<state> ::= <DISC>

<DISC> ::= CURRent | VOLTage

CURRent → Current monitor output mode

SCURrent → Single Current monitor output mode

VOLTage → Voltage monitor output mode

Query parameter

None

Response format

<DISC>

Setting example

OUTP:MON:MODE CURR

Query example

OUTP:MON:MODE?

Response example

CURR

Remarks

The setting is error during the System Lock/warning.

4.2.1.41 Set Output Current Limit: Set/Get Current Limit (Effective Value)

[:SOURce]:CURRent:LIMit:RMS[:AMPLitude]

Description

Sets/gets the current effective value [Arms] limiter

Setting parameter

<cur lim rms> | MINimum | MAXimum

<cur lim rms > ::= <REAL>

<REAL> →Output current effective value

MINimum → Minimum value

MAXimum → Maximum value

For the setting value range, maximum value, minimum value, and resolution, see the instruction manual of the main unit.

Query parameter

[MINimum | MAXimum]

MINimum → Gets the minimum value

MAXimum → Gets the maximum value

Response format

<NR2>

Setting example

CURR:LIM:RMS 5

Query example

CURR:LIM:RMS?

Response example

5.0

Remarks

The setting is error during the System Lock/warning.

4.2.1.42 Set Output Current Limit: Set/Get Output OFF at Current Limit (Effective Value) Detection [:SOURce]:CURRent:LIMit:RMS:MODE

Description

Sets/gets the output off after the RMS current limiter is activated

Setting parameter

<cur lim mode> ::= <DISC>

<DISC> ::= CONTinuous | OFF

CONTinuous → Continuous operation, output off disabled

OFF → Output off enabled

Query parameter

None

Response format

<DISC>

Setting example

CURR:LIM:RMS:MODE OFF

Query example

CURR:LIM:RMS:MODE?

Response example

OFF

Remarks

The setting is error during the System Lock/warning.

4.2.1.43 Set Output Current Limit: Set/Get Time Before Turning Output OFF After Current Limit (Effective Value) is Detected

[:SOURce]:CURRent:LIMit:RMS:TIME

Description

Sets/gets the time [s] before turning the output off after the RMS current limiter is activated

Setting parameter

<cur lim time> | MINimum | MAXimum

<cur lim time> ::= <INT>

<INT> → Limiter time: 1 to 10

MINimum → 1

MAXimum → 10

Query parameter

[MINimum | MAXimum]

MINimum → Gets the minimum value

MAXimum → Gets the maximum value

Response format

<INT>

Setting example

CURR:LIM:RMS:TIME 5

Query example

CURR:LIM:RMS:TIME?

Response example

5

Remarks

The setting is error during the System Lock/warning.

4.2.1.44 Set Output Current Limit: Set/Get Current Limit (Peak Value <Maximum>)

[:SOURce]:CURRent:LIMit:PEAK:HIGH

Description

Sets/gets the peak current limiter (positive) [A]

Setting parameter

<cur lim peak high> | MINimum | MAXimum

<cur lim peak high> ::= <REAL>

<REAL> → Peak current limiter (positive) setting value

MINimum → Minimum value

MAXimum → Maximum value

For the setting value range, maximum value, minimum value, and resolution, see the instruction manual of the main unit.

Query parameter

[MINimum | MAXimum]

MINimum → Gets the minimum value

MAXimum → Gets the maximum value

Response format

<NR2>

Setting example

CURR:LIM:PEAK:HIGH 10

Query example

CURR:LIM:PEAK:HIGH?

Response example

10.0

Remarks

The setting is error during the System Lock/warning.

4.2.1.45 Set Output Current Limit: Set/Get Current Limit (Peak Value <Minimum>)

[:SOURce]:CURRent:LIMit:PEAK:LOW

Description

Sets/gets the peak current limiter (negative) [A]

Setting parameter

<cur lim peak low> | MINimum | MAXimum

<cur lim peak low> ::= <REAL>

<REAL> → Peak current limiter (negative) setting value

MINimum → Minimum value

MAXimum → Maximum valueFor the setting value range, maximum value, minimum value, and resolution, see the instruction manual of the main unit.

Query parameter

[MINimum | MAXimum]

MINimum → Gets the minimum value

MAXimum → Gets the maximum value

Response format

<NR2>

Setting example

CURR:LIM:PEAK:LOW -10

Query example

CURR:LIM:PEAK:LOW?

Response example

-10.0

Remarks

The setting is error during the System Lock/warning.

4.2.1.46 Set Output Current Limit: Set/Get Output OFF at Current Limit (Peak Value) Detection [:SOURce]:CURRent:LIMit:PEAK:MODE

Description

Sets/gets the output off after the peak current limiter is activated

Setting parameter

<cur lim mode> ::= <DISC>

<DISC> ::= CONTinuous | OFF

CONTinuous → Continuous operation, output off disabled

OFF → Output off enabled

Query parameter

None

Response format

<DISC>

Setting example

CURR:LIM:PEAK:MODE OFF

Query example

CURR:LIM:PEAK:MODE?

Response example

OFF

Remarks

The setting is error during the System Lock/warning.

4.2.1.47 Set Output Current Limit: Set/Get Time Before Turning Output OFF After Current Limit (Peak Value) is Detected

[:SOURce]:CURRent:LIMit:PEAK:TIME

Description

Sets/gets the time [s] before turning the output off after the peak current limiter is activated

Setting parameter

<cur lim time> | MINimum | MAXimum

<cur lim time> ::= <INT>

<INT> → Limiter time: 1 to 10

MINimum → 1

MAXimum → 10

Query parameter

[MINimum | MAXimum]

MINimum → Gets the minimum value

MAXimum → Gets the maximum value

Response format

<INT>

Setting example

CURR:LIM:PEAK:TIME 5

Query example

CURR:LIM:PEAK:TIME?

Response example

5

Remarks

The setting is error during the System Lock/warning.

4.2.1.48 Output Setting (for All Phases): Set/Get Output Range

[:SOURce]:VOLTage:RANGe

Description

Sets/gets the output range

Setting parameter

<volt range> ::= <DISC>

<DISC> ::= R100V | R200V

R100V → 100V range

R200V → 200V range

Query parameter

None

Response format

<DISC>

Setting example

VOLT:RANG R100V

Query example

VOLT:RANG?

Response example

R100V

Remarks

The setting is error during the System Lock/warning.

The setting cannot be done during the output on.

4.2.1.49 Output Setting (for All Phases): Set/Get Operation Mode

[:SOURce]:MODE

Description

Sets/gets the operation mode

Setting parameter

<mode> ::= <DISC>

<DISC> ::= AC_INT | AC_VCA | AC_SYNC | AC_EXT | AC_ADD | DC_INT | DC_VCA |ACDC_INT | ACDC_SYNC | ACDC_EXT | ACDC_ADD

AC_INT → AC-INT mode

AC_VCA → AC-VCA mode

AC_SYNC → AC-SYNC mode

AC_EXT → AC-EXT mode

AC_ADD → AC-ADD mode

DC_INT → DC-INT mode

DC_VCA → DC-VCA mode

ACDC_INT → ACDC-INT mode

ACDC_SYNC→ ACDC-SYNC mode

ACDC_EXT → ACDC-EXT mode

ACDC_ADD → ACDC-ADD mode

Query parameter

None

Response format

<DISC>

Setting example

MODE ACDC_INT

Query example

MODE?

Response example

ACDC_INT

Remarks

The setting is error during the System Lock/warning.

4.2.1.50 Set/Get Output Waveform: Set/Get Clipped Sine Wave Type Specification

[:SOURce]:FUNCtion:CSINe:TYPE

Description

Sets/gets the clipped sine wave setting type

Setting parameter

<func shap>,<type>

<func shap> ::= <DISC>

<DISC> ::= CLP1 | CLP2 | CLP3

CLP1 → Clipped sine wave 1

CLP2 → Clipped sine wave 2

CLP3 → Clipped sine wave 3

<type> ::= <DISC>

<DISC> ::= CFACtor | CLIP

CFACtor → Crest factor

CLIP → Clip

Query parameter

<func shap>

<func shap> ::= <DISC>

<DISC> ::= CLP1 | CLP2 | CLP3

Response format

<DISC>

Setting example

FUNC:CSIN:TYPE CLP1, CFACTOR

Query example

FUNC:CSIN:CFAC? CLP1

Response example

CFAC

Remarks

The setting is error during the System Lock/warning.

4.2.1.51 Set/Get Output Waveform: Set/Get Clipped Sine Wave Crest Factor

[:SOURce]:FUNCtion:CSINe:CFACtor

Description

Sets/gets the clipped sine wave crest factor

Setting parameter

<func shap>,{<cf> | MINimum | MAXimum}

<func shap> ::= <DISC>

<DISC> ::= CLP1 | CLP2 | CLP3

CLP1 → Clipped sine wave 1

CLP2 → Clipped sine wave 2

CLP3 → Clipped sine wave 3

<cf> ::= <REAL>

<REAL> → Crest factor: 1.10 to 1.41, Resolution 0.01

MINimum → 1.10

MAXimum → 1.41

Query parameter

<func shap>[, MINimum | MAXimum]

<func shap> ::= <DISC>

<DISC> ::= CLP1 | CLP2 | CLP3

MINimum → Gets the minimum value

MAXimum → Gets the maximum value

Response format

<NR2>

Setting example

FUNC:CSIN:CFAC CLP1,1.2

Query example

FUNC:CSIN:CFAC? CLP1

Response example

1.20

Remarks

The setting is error during the System Lock/warning.

4.2.1.52 Set/Get Output Waveform: Set/Get Clipped Sine Wave Clip Ratio

[:SOURce]:FUNCtion:CSINe:CLIP

Description

Sets/gets the clipped sine wave clip ratio

Setting parameter

<func shap>,{<clip> | MINimum | MAXimum}

<func shap> ::= <DISC>

<DISC> ::= CLP1 | CLP2 | CLP3

CLP1 → Clipped sine wave 1

CLP2 → Clipped sine wave 2

CLP3 → Clipped sine wave 3

<clip> ::= <REAL>

<REAL> → Clip ratio: 40.0 to 100.0, Resolution 0.1

MINimum → 40.0

MAXimum → 100.0

Query parameter

<func shap>[, MINimum | MAXimum]

<func shap> ::= <DISC>

<DISC> ::= CLP1 | CLP2 | CLP3

MINimum → Gets the minimum value

MAXimum → Gets the maximum value

Response format

<NR2>

Setting example

FUNC:CSIN:CLIP CLP1, 80

Query example

FUNC:CSIN:CLIP? CLP1

Response example

80.0

Remarks

The setting is error during the System Lock/warning.

4.2.1.53 Factory Setting: Execute Factroy Set

:SYSTem:INIT

Description

Execute factory set

Setting parameter

NONE

Setting example

:SYST:INIT

Remark

The setting is error during the System Lock/warning.

This command can only be used when only one device is running.

The setting cannot be done during the output on.

Executing this command will switch to the USB interface.

4.2.1.54 Date and Time Settings: Set/get Date and Time

:SYSTem:DATE

Description

Sets/gets Date and Time

Setting parameter

<year>,<month>,<day>,<hour>,<minute>,<second>

<year> ::= <INT>

<INT> ::= year: 2022～2099

<month> ::= <INT>

<INT> ::= month: 1～12

<day> ::= <INT>

<INT> ::= day: 1~31

<hour> ::= <INT>

<INT> ::= hour: 0～23

<minute> ::= <INT>

<INT> ::= minute: 0～59

<second> ::= <INT>

<INT> ::= second: 0～59

Query parameter

NONE

Response format

<INT>,<INT>,<INT>,<INT>,<INT>,<INT>

Returns year, month, day, hour, minute, second in order.

Setting example

SYST:DATE 2023,9,14,10,46,40

Query example

SYST:DATE?

Response example

2023,9,14,10,46,45

4.2.2 Continuous Function Commands

4.2.2.1 Common Command (IEEE488.2): Read Basic Setting Data

*RCL

Description

Read the basic setting data

Setting parameter

<meomory> ::= <INT>

<INT> →Basic Setting Memory number: 0 to 30

Setting example

* RCL 8

Remarks

The setting is error during the System Lock/warning.

The operation cannot be done during the output on.

4.2.2.2 Common Command (IEEE488.2): Save the Basic Setting Data

*SAV

Description

Save the basic setting data

Setting parameter

<memory> ::= <INT>

<INT> → Basic Setting Memory number: 1 to 30

Setting example

*SAV 8

Remarks

The setting is error during the System Lock/warning.

The operation cannot be done during the output on.

4.2.2.3 Panel Display Setting: Set/Get Measurement Display Selection

:DISPlay[:WINDow]:MEASure:MODE

Description

Sets/gets the measurement display selection

Setting parameter

<disp meas mode> ::= <DISC>

<DISC> ::= RMS | RMS2 | AVG | AVG2 | PEAK | PEAK2 | HC1 | HC2 | HC3 | HC4

RMS → Effective value

RMS2 → Effective value2

AVG → Average value

AVG2 → Average value2

PEAK → Peak value

PEAK2 → Peak value2

HC1 → Harmonic current 1

HC2 → Harmonic current 2

HC3 → Harmonic current 3

HC4 → Harmonic current 4

Query parameter

None

Response format

<DISC>

Setting example

DISP:MEAS:MODE RMS

Query example

DISP:MEAS:MODE?

Response example

RMS

Remarks

The setting is error during the System Lock/warning.

4.2.2.4 Output Setting (for All Phases): Set/Get Output Frequency

[:SOURce]:FREQuency[:IMMediate]

Description

Sets/gets the output frequency

Setting parameter

<frequency> | MINimum | MAXimum

<frequency> ::= <REAL>

<REAL> → Frequency: The range that can be used are as follows.

40.00 to 550.0 (AC)

1.00 to 550.0 (ACDC)

Resolution 0.01(<100Hz), 0.1(<1000Hz)

MINimum → 40.00 (AC)/1.00 (ACDC)

MAXimum → 550.0(AC, ACDC)

Query parameter

[MINimum | MAXimum]

MINimum → Gets the minimum value

MAXimum → Gets the maximum value

Response format

<NR2>

Setting example

FREQ 50

Query example

FREQ?

Response example

50.0

Remarks

The setting is error during the System Lock/warning.

The setting can be made only in the AC-INT, AC-VCA, AC-ADD, ACDC-INT, and ACDC-ADD modes.

4.2.2.5 Output Setting (for All Phases): Set/Get Output On Phase

[:SOURce]:PHASe:STARt[:IMMediate]

Description

Sets/gets the output on phase

Setting parameter

<phase> | MINimum | MAXimum

<phase> ::= <REAL>

<REAL> → Phase: 0.0 to 359.9, Resolution 0.1

MINimum → 0.0

MAXimum → 359.9

Query parameter

[MINimum | MAXimum]

MINimum → Gets the minimum value

MAXimum → Gets the maximum value

Response format

<NR2>

Setting example

PHAS:STAR 90

Query example

PHAS:STAR?

Response example

90.0

Remarks

The setting is error during the System Lock/warning.

The setting cannot be done in the AC-EXT, ACDC-EXT, DC-INT, and DC-VCA modes.

4.2.2.6 Output Setting (for All Phases): Enable/Disable Output Off Phase Specification

[:SOURce]:PHASe:STOP:ENABle

Description

Sets/gets whether to enable/disable the output off phase

Setting parameter

<state> ::= <BOL>

<BOL> → 0/OFF: Disable, 1/ON: Enable

Query parameter

None

Response format

<NBOL>

Setting example

PHAS:STOP:ENAB ON

Query example

PHAS:STOP:ENAB?

Response example

1

Remarks

The setting is error during the System Lock/warning.

The setting cannot be done in the AC-EXT, ACDC-EXT, DC-INT, and DC-VCA modes.

4.2.2.7 Output Setting (for All Phases): Set/Get Output Off Phase

[:SOURce]:PHASe:STOP[:IMMediate]

Description

Sets/gets the output off phase

Setting parameter

<phase> | MINimum | MAXimum

<phase> ::= <REAL>

<REAL> → Phase: 0.0 to 359.9, Resolution 0.1

MINimum → 0.0

MAXimum → 359.9

Query parameter

[MINimum | MAXimum]

MINimum → Gets the minimum value

MAXimum → Gets the maximum value

Response format

<NR2>

Setting example

PHAS:STOP 90

Query example

PHAS:STOP?

Response example

90.0

Remarks

The setting is error during the System Lock/warning.

The setting cannot be done in the AC-EXT, ACDC-EXT, DC-INT, and DC-VCA modes.

4.2.2.8 Output Setting (for All Phases): Set/Get Remote Sensing Function :MEASure:CONFigure:SENSing

Description

Sets/gets the remote sensing

Setting parameter

<state> ::= <INT>

<INT> → 0: Disable, 1: Enable

Query parameter

None

Response format

<INT>

Setting example

MEAS:CONF:SENS 1

Query example

MEAS:CONF:SENS?

Response example

1

Remarks

The setting is error during the System Lock/warning.

The remote sensing can be set only when the waveform is a sine wave for the AC mode in the AC-INT, AC-VCA, AC-SYNC, DC-INT, and DC-VCA modes.

4.2.2.9 Output Setting (for Specific Phase): Set/Get AC Output Voltage

[:SOURce]:VOLTage[:LEVel][:IMMediate][:AMPLitude]

Description

Sets/gets the AC output voltage

Setting parameter

<volt> | MINimum | MAXimum

<volt> ::= <REAL>

<REAL> →AC output voltage

MINimum → Minimum value

MAXimum → Maximum value

For the setting value range, maximum value, minimum value, and resolution, see the instruction manual of the main unit.

Query parameter

[MINimum | MAXimum]

MINimum → Gets the minimum value

MAXimum → Gets the maximum value

Response format

<NR2>

Setting example

VOLT 100

Query example

VOLT?

Response example

100.0

Remarks

The setting is error during the System Lock/warning.

4.2.2.10 Output Setting (for Specific Phase): Set/Get DC Output Voltage

[:SOURce]:VOLTage[:LEVel][:IMMediate]:OFFSet

Description

Sets/gets the DC output voltage

Setting parameter

<volt offs> | MINimum | MAXimum

<volt offs> ::= <REAL>

<REAL> → DC output voltage

MINimum → Minimum value

MAXimum → Maximum value

For the setting value range, maximum value, minimum value, and resolution, see the instruction manual of the main unit.

Query parameter

[MINimum | MAXimum]

MINimum → Gets the minimum value

MAXimum → Gets the maximum value

Response format

<NR2>

Setting example

VOLT:OFFS 10

Query example

VOLT:OFFS?

Response example

10.0

Remarks

The setting is error during the System Lock/warning.

4.2.2.11 Output Setting (for Specific Phase): Set/Get Output Waveform

[:SOURce]:FUNCtion[:SHAPe][:IMMediate]

Description

Sets/gets the output waveform

Setting parameter

<func shap> ::= <DISC>

<DISC> ::= SIN | CLP1 | CLP2 | CLP3

SIN → Sine wave

CLP1 → Clipped sine wave 1

CLP2 → Clipped sine wave 2

CLP3 → Clipped sine wave 3

Query parameter

None

Response format

<DISC>

Setting example

FUNC SIN

Query example

FUNC?

Response example

SIN

Remarks

The setting is error during the System Lock/warning.

4.2.2.12 Output Setting (for Specific Phase): Set/Get DC Offset Voltage Adjustment Value (AC mode)

[:SOURce]:VOLTage:ADJust:OFFSet:AC

Description

Sets/gets the DC offset voltage adjustment value [mV] in the AC mode

Setting parameter

<adjust voltage> | MINimum | MAXimum

<adjust voltage> ::= <REAL>

<REAL> → Voltage adjustment value

MINimum → Minimum value

MAXimum → Maximum value

For the setting value range, maximum value, minimum value, and resolution, see the instruction manual of the main unit.

Query parameter

[MINimum | MAXimum]

MINimum → Gets the minimum value

MAXimum → Gets the maximum value

Response format

<NR2>

Setting example

VOLT:ADJ:OFFS:AC 10

Query example

VOLT:ADJ:OFFS:AC?

Response example

10.0

Remarks

The setting is error during the System Lock/warning.

4.2.2.13 Output Setting (for Specific Phase): Set/Get DC Offset Voltage Adjustment Value (ACDC and DC modes)

[:SOURce]:VOLTage:ADJust:OFFSet:DC

Description

Sets/gets the DC offset voltage adjustment value [mV] in the ACDC and DC modes

Setting parameter

<adjust voltage> | MINimum | MAXimum

<adjust voltage> ::= <REAL>

<REAL> → Voltage adjustment value

MINimum → Minimum value

MAXimum → Maximum value

For the setting value range, maximum value, minimum value, and resolution, see the instruction manual of the main unit.

Query parameter

[MINimum | MAXimum]

MINimum → Gets the minimum value

MAXimum → Gets the maximum value

Response format

<INT>

Setting example

VOLT:ADJ:OFFS:DC 10

Query example

VOLT:ADJ:OFFS:DC?

Response example

10

Remarks

The setting is error during the System Lock/warning.

4.2.2.14 Set Output Voltage Limit: Set/Get Voltage Limit (Effective Value)

[:SOURce]:VOLTage:LIMit:RMS

Description

Sets/gets the effective voltage setting range limit (effective value)

Setting parameter

<volt lim low> | MINimum | MAXimum

<volt lim low> ::= <REAL>

<REAL> → Voltage upper limit value

MINimum → Minimum value

MAXimum → Maximum value

For the setting value range, maximum value, minimum value, and resolution, see the instruction manual of the main unit.

Query parameter

[MINimum | MAXimum]

MINimum → Gets the minimum value

MAXimum → Gets the maximum value

Response format

<NR2>

Setting example

VOLT:LIM:RMS 100

Query example

VOLT:LIM:RMS?

Response example

100.0

Remarks

The setting is error during the System Lock/warning.

4.2.2.15 Set Output Voltage Limit: Set/Get Voltage Limit (Peak Value <Maximum>)

[:SOURce]:VOLTage:LIMit:HIGH

Description

Sets/gets the voltage setting range limit (peak value <maximum>)

Setting parameter

<volt lim high> | MINimum | MAXimum

<volt lim high> ::= <REAL>

<REAL> → Output voltage upper limit

MINimum → Minimum value

MAXimum → Maximum value

For the setting value range, maximum value, minimum value, and resolution, see the instruction manual of the main unit.

Query parameter

[MINimum | MAXimum]

MINimum → Gets the minimum value

MAXimum → Gets the maximum value

Response format

<NR2>

Setting example

VOLT:LIM:HIGH 200

Query example

VOLT:LIM:HIGH?

Response example

200.0

Remarks

The setting is error during the System Lock/warning.

4.2.2.16 Set Output Voltage Limit: Set/Get Voltage Limit (Peak Value <Minimum>)

[:SOURce]:VOLTage:LIMit:LOW

Description

Sets/gets the voltage setting range limit (peak value <minimum>)

Setting parameter

<volt lim low> | MINimum | MAXimum

<volt lim low> ::= <REAL>

<REAL> → Output voltage lower limit

MINimum → Minimum value

MAXimum → Maximum value

For the setting value range, maximum value, minimum value, and resolution, see the instruction manual of the main unit.

Query parameter

[MINimum | MAXimum]

MINimum → Gets the minimum value

MAXimum → Gets the maximum value

Response format

<NR2>

Setting example

VOLT:LIM:LOW -200

Query example

VOLT:LIM:LOW?

Response example

-200.0

Remarks

The setting is error during the System Lock/warning.

4.2.2.17 Set Output Frequency Setting Range Limit: Set/Get Upper Limit Value of Frequency Limit

[:SOURce]:FREQuency:LIMit:HIGH

Description

Sets/gets the upper limit value [Hz] of the frequency setting range limit

Setting parameter

<frequency> | MINimum | MAXimum

<frequency> ::= <REAL>

<REAL> → Frequency: The range that can be used are as follows.

40.00 to 550.0 (AC)

1.00 to 550.0 (ACDC)

Resolution 0.01(<100Hz), 0.1(<1000Hz)

MINimum → 40.00 (AC)/1.00 (ACDC)

MAXimum → 550.0(AC, ACDC)

Query parameter

[MINimum | MAXimum]

MINimum → Gets the minimum value

MAXimum → Gets the maximum value

Response format

<NR2>

Setting example

FREQ:LIM:HIGH 60

Query example

FREQ:LIM:HIGH?

Response example

60.00

Remarks

The setting is error during the System Lock/warning.

The setting can be made only in the AC-INT, AC-VCA, AC-ADD, ACDC-INT, and ACDC-ADD modes.

4.2.2.18 Set Output Frequency Setting Range Limit: Set/Get Lower Limit Value of Frequency Limit

[:SOURce]:FREQuency:LIMit:LOW

Description

Sets/gets the lower limit value [Hz] of the frequency setting range limit

Setting parameter

<frequency> | MINimum | MAXimum

<frequency> ::= <REAL>

<REAL> → Frequency: The range that can be used are as follows.

40.00 to 550.0 (AC)

1.00 to 550.0 (ACDC)

Resolution 0.01(<100Hz), 0.1(<1000Hz)

MINimum → 40.00 (AC)/1.00 (ACDC)

MAXimum → 550.0(AC, ACDC)

Query parameter

[MINimum | MAXimum]

MINimum → Gets the minimum value

MAXimum → Gets the maximum value

Response format

<NR2>

Setting example

FREQ:LIM:LOW 40

Query example

FREQ:LIM:LOW?

Response example

40.00

Remarks

The setting is error during the System Lock/warning.

The setting can be made only in the AC-INT, AC-VCA, AC-ADD, ACDC-INT, and ACDC-ADD modes.

4.2.2.19 Get Output Measured Value: Clear Current Peak-Hold Value

:MEASure[:SCALar]:CURRent:PEAK:CLEar

Description

Clears the current peak-hold value

Setting parameter

None

Setting example

MEAS:CURR:PEAK:CLE

Remarks

The setting is error during the System Lock/warning.

4.2.2.20 Get Output Measured Value: Current Peak-Hold Value

:MEASure[:SCALar]:CURRent:PEAK:HOLD?

Description

Gets the current peak-hold value [Apk]

Query parameter

None

Response format

<NR2>→ Query response range

For the query response range and resolution, see the instruction manual of the main unit.

Query example

MEAS:CURR:PEAK:HOLD?

Response example

26.55

Remarks

If overrange occurs, returns 9999999.

If the measurement conditions are not met, 99999999 is returned.

4.2.2.21 Get Output Measured Value: Clear Voltage Peak-Hold Value

:MEASure[:SCALar]:VOLTage:PEAK:CLEar

Description

Clears the voltage peak-hold value

Setting parameter

None

Setting example

MEAS:VOLT:PEAK:CLE

Remarks

The setting is error during the System Lock/warning.

4.2.2.22 Get Output Measured Value: Voltage Peak-Hold Value

:MEASure[:SCALar]:VOLTage:PEAK:HOLD?

Description

Gets the voltage peak-hold value [Vpk]

Query parameter

None

Response format

<NR2>→ Query response range

For the query response range and resolution, see the instruction manual of the main unit.

Query example

MEAS:VOLT:PEAK:HOLD?

Response example

106.0

Remarks

If overrange occurs, returns 9999999.

If the measurement conditions are not met, 99999999 is returned.

4.2.2.23 Get Output Measured Value: Synchronization Signal Source Frequency

:MEASure[:SCALar]:FREQuency?

Description

Gets the synchronization signal source frequency [Hz]

Query parameter

None

Response format

<NR2>→ Query response range

For the query response range and resolution, see the instruction manual of the main unit.

Query example

MEAS:FREQ?

Response example

50.4

Remarks

If overrange occurs, returns 9999999.

If the measurement conditions are not met, 99999999 is returned.

4.2.2.24 Get Output Measured Value (for Specific Phase): Output Voltage (Effective Value)

:MEASure[:SCALar]:VOLTage[:RMS]?

Description

Gets the output voltage effective value [Vrms]

Query parameter

None

Response format

<NR2>→ Query response range

For the query response range and resolution, see the instruction manual of the main unit.

Query example

MEAS:VOLT?

Response example

100.4

Remarks

If overrange occurs, returns 9999999.

If the measurement conditions are not met, 99999999 is returned.

4.2.2.25 Get Output Measured Value (for Specific Phase): Output Voltage (Average Value)

:MEASure[:SCALar]:VOLTage:AVErage?

Description

Gets the output voltage average value [V]

Query parameter

None

Response format

<NR2>→ Query response range

For the query response range and resolution, see the instruction manual of the main unit.

Query example

MEAS:VOLT:AVE?

Response example

100.0

Remarks

If overrange occurs, returns 9999999.

If the measurement conditions are not met, 99999999 is returned.

4.2.2.26 Get Output Measured Value (for Specific Phase): Output Voltage (Peak Value <Maximum>)

:MEASure[:SCALar]:VOLTage:HIGH?

Description

Gets the voltage maximum value [Vpk]

Query parameter

None

Response format

<NR2>→ Query response range

For the query response range and resolution, see the instruction manual of the main unit.

Query example

MEAS:VOLT:HIGH?

Response example

141.4

Remarks

If overrange occurs, returns 9999999.

If the measurement conditions are not met, 99999999 is returned.

4.2.2.27 Get Output Measured Value (for Specific Phase): Output Voltage (Peak Value <Minimum>)
:MEASure[:SCALar]:VOLTage:LOW?

Description

Gets the voltage minimum value [Vpk]

Query parameter

None

Response format

<NR2>→ Query response range

For the query response range and resolution, see the instruction manual of the main unit.

Query example

MEAS:VOLT:LOW?

Response example

-141.4

Remarks

If overrange occurs, returns 9999999.

If the measurement conditions are not met, 99999999 is returned.

4.2.2.28 Get Output Measured Value (for Specific Phase): Output Voltage Crest Factor
:MEASure[:SCALar]:VOLTage:CFACtor?

Description

Gets the output voltage crest factor

Query parameter

None

Response format

<NR2>→ Query response range

For the query response range and resolution, see the instruction manual of the main unit.

Query example

MEAS:VOLT:CRES?

Response example

1.41

Remarks

If overrange occurs, returns 9999999.

If the measurement conditions are not met, 99999999 is returned.

4.2.2.29 Get Output Measured Value (for Specific Phase): Output Current (Effective Value)
:MEASure[:SCALar]:CURRent[:RMS]?

Description

Gets the output current effective value [Arms]

Query parameter

None

Response format

<NR2>→ Query response range

For the query response range and resolution, see the instruction manual of the main unit.

Query example

MEAS:CURR?

Response example

12.75

Remarks

If overrange occurs, returns 9999999.

If the measurement conditions are not met, 99999999 is returned.

4.2.2.30 Get Output Measured Value (for Specific Phase): Output Current (Average)
:MEASure[:SCALar]:CURRent:AVErage?

Description

Gets the output current average value [A]

Query parameter

None

Response format

<NR2>→ Query response range

For the query response range and resolution, see the instruction manual of the main unit.

Query example

MEAS:CURR:AVE?

Response example

1.20

Remarks

If overrange occurs, returns 9999999.

If the measurement conditions are not met, 99999999 is returned.

4.2.2.31 Get Output Measured Value (for Specific Phase): Output Current (Peak Value <Maximum>)
:MEASure[:SCALar]:CURRent:HIGH?

Description

Gets the output current maximum peak value [Apk]

Query parameter

None

Response format

<NR2>→ Query response range

For the query response range and resolution, see the instruction manual of the main unit.

Query example

MEAS:CURR:HIGH?

Response example

30.0

Remarks

If overrange occurs, returns 9999999.

If the measurement conditions are not met, 99999999 is returned.

4.2.2.32 Get Output Measured Value (for Specific Phase): Output Current (Peak Value <Minimum>)
:MEASure[:SCALar]:CURRent:LOW?

Description

Gets the output current minimum peak value [Apk]

Query parameter

None

Response format

<NR2>→ Query response range

For the query response range and resolution, see the instruction manual of the main unit.

Query example

MEAS:CURR:LOW?

Response example

-30.0

Remarks

If overrange occurs, returns 9999999.

If the measurement conditions are not met, 99999999 is returned.

4.2.2.33 Get Output Measured Value (for Specific Phase): Set/Get Control Harmonic Measurement Type :MEASure[:SCALar]:HARMonic:TYPE

Description

Sets/gets the harmonic measurement type

Setting parameter

<type> ::= <DISC>

<DISC> ::= CURRent | VOLTage

CURRent → Harmonic current type

VOLTage → Harmonic voltage type

Query parameter

None

Response format

<NBOL>

Setting example

MEAS:HARM:TYPE CURR

Query example

MEAS:HARM:TYPE CURR?

Response example

CURR

Remarks

The setting is error during the System Lock/warning.

4.2.2.34 Get Output Measured Value (for Specific Phase): Harmonic Voltage Value

:MEASure[:SCALar]:VOLTage:HARMonic[:RMS]?

Description

Gets the harmonic voltage [Vrms]

Query parameter

< page > ::= <INT> | MINimum | MAXimum

<INT> → Page: 1 to 5

1 (order 1 to 10) | 2 (order 11 to 20) | 3 (order 21 to 30) |

4 (order 31 to 40) | 5(order 41 to 50)

MINimum → 1

MAXimum → 5

Response format

<NR2>,<NR2>,<NR2>,<NR2>,<NR2>,<NR2>,<NR2>,<NR2>,<NR2>,<NR2>

→ Query response range

For the query response range and resolution, see the instruction manual of the main unit.

Query example

MEAS:VOLT:HARM? 1

Response example

2.24,0.02,0.01,0.15,0.06,0.08,0.01,0.01,0.02,0.06

Remarks

If overrange occurs, returns 9999999.

If the measurement conditions are not met, 99999999 is returned.

4.2.2.35 Get Output Measured Value (for Specific Phase): Harmonic Voltage Percentage

:MEASure[:SCALar]:VOLTage:HARMonic:RATio?

Description

Gets the harmonic voltage percentage [%]

Query parameter

< page > ::= <INT> | MINimum | MAXimum

<INT> → Page: 1 to 5

1 (order 1 to 10) | 2 (order 11 to 20) | 3 (order 21 to 30) |

4 (order 31 to 40) | 5(order 41 to 50)

MINimum → 1

MAXimum → 5

Response format

<NR2>,<NR2>,<NR2>,<NR2>,<NR2>,<NR2>,<NR2>,<NR2>,<NR2>,<NR2>

→ Query response range

For the query response range and resolution, see the instruction manual of the main unit.

Query example

MEAS:VOLT:HARM:RAT? 1

Response example

100.0,0.1,0.1,0.1,0.1,0.1,0.1,0.1,0.1,0.1

Remarks

If overrange occurs, returns 9999999.

If the measurement conditions are not met, 99999999 is returned.

4.2.2.36 Get Output Measured Value (for Specific Phase): Set/Get Control Harmonic Measurement Function

:MEASure[:SCALar]:CURRent:HARMonic:ENABle

Description

Sets/gets whether to enable/disable the harmonic current measurement.

If harmonic current measurement is enabled with this command, harmonic voltage measurement will be disabled.

Setting parameter

<state> ::= <BOL>

<BOL> → 0/OFF: Do nothing, 1/ON: Enable

Query parameter

None

Response format

<NBOL>

Setting example

MEAS:CURR:HARM:ENAB ON

Query example

MEAS:CURR:HARM:ENAB?

Response example

1

Remarks

The setting is error during the System Lock/warning.

4.2.2.37 Get Output Measured Value (for Specific Phase): Harmonic Current Value

:MEASure[:SCALar]:CURRent:HARMonic[:RMS]?

Description

Gets the harmonic current [Arms]

Query parameter

< page > ::= <INT> | MINimum | MAXimum

<INT> → Page: 1 to 5

1 (order 1 to 10) | 2 (order 11 to 20) | 3 (order 21 to 30) |

4 (order 31 to 40) | 5(order 41 to 50)

MINimum → 1

MAXimum → 5

Response format

<NR2>,<NR2>,<NR2>,<NR2>,<NR2>,<NR2>,<NR2>,<NR2>,<NR2>,<NR2>

→ Query response range

For the query response range and resolution, see the instruction manual of the main unit.

Query example

MEAS:CURR:HARM? 1

Response example

2.24,0.02,0.01,0.15,0.06,0.08,0.01,0.01,0.02,0.06

Remarks

If overrange occurs, returns 9999999.

If the measurement conditions are not met, 99999999 is returned.

4.2.2.38 Get Output Measured Value (for Specific Phase): Harmonic Current Percentage

:MEASure[:SCALar]:CURRent:HARMonic:RATio?

Description

Gets the harmonic current percentage [%]

Query parameter

< page > ::= <INT> | MINimum | MAXimum

<INT> → Page: 1 to 5

1 (order 1 to 10) | 2 (order 11 to 20) | 3 (order 21 to 30) |

4 (order 31 to 40) | 5(order 41 to 50)

MINimum → 1

MAXimum → 5

Response format

<NR2>,<NR2>,<NR2>,<NR2>,<NR2>,<NR2>,<NR2>,<NR2>,<NR2>,<NR2>

→ Query response range

For the query response range and resolution, see the instruction manual of the main unit.

Query example

MEAS:CURR:HARM:RAT? 1

Response example

100.0,0.1,0.1,0.1,0.1,0.1,0.1,0.1,0.1,0.1

Remarks

If overrange occurs, returns 9999999.

If the measurement conditions are not met, 99999999 is returned.

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4.2.2.39 Get Output Measured Value (for Specific Phase): Output Current Crest Factor

:MEASure[:SCALar]:CURRent:CFACtor?

Description

Gets the output current crest factor

Query parameter

None

Response format

<NR2>→ Query response range

For the query response range and resolution, see the instruction manual of the main unit.

Query example

MEAS:CURR:CRES?

Response example

1.41

Remarks

If overrange occurs, returns 9999999.

If the measurement conditions are not met, 99999999 is returned.

4.2.2.40 Get Output Measured Value (for Specific Phase): Apparent Power

:MEASure[:SCALar]:POWer[:AC]:APParent?

Description

Gets the apparent power [VA]

Query parameter

None

Response format

<INT>→ (1000 [VA] or more)

<NR2>→ (Less than 1000 [VA])

Query response range

For the query response range and resolution, see the instruction manual of the main unit.

Query example

MEAS:POW:APP?

Response example

367.0

Remarks

If overrange occurs, returns 9999999.

If the measurement conditions are not met, 99999999 is returned.

4.2.2.41 Get Output Measured Value (for Specific Phase): Power Factor

:MEASure[:SCALar]:POWer[:AC]:PFACtor?

Description

Gets the power factor

Query parameter

None

Response format

<NR2>→ Query response range

For the query response range and resolution, see the instruction manual of the main unit.

Query example

MEAS:POW:PFAC?

Response example

0.68

Remarks

If overrange occurs, returns 9999999.

If the measurement conditions are not met, 99999999 is returned.

4.2.2.42 Get Output Measured Value (for Specific Phase): Active Power

:MEASure[:SCALar]:POWer[:AC][:REAL]?

Description

Gets the active power [W]

Query parameter

None

Response format

<INT>→ (1000 [W] or more)

<NR2>→ (Less than 1000 [W])

For the query response range and resolution, see the instruction manual of the main unit.

Query example

MEAS:POW?

Response example

249.0

Remarks

If overrange occurs, returns 9999999.

If the measurement conditions are not met, 99999999 is returned.

4.2.2.43 Set Output Correction Function: Enable/Disable AGC Function

:OUTPut:AGC

Description

Sets/gets the AGC

Setting parameter

<state> ::= <BOL>

<BOL> → 0/OFF: Disable, 1/ON: Enable

Query parameter

None

Response format

<NBOL>

Setting example

OUTP:AGC ON

Query example

OUTP:AGC?

Response example

1

Remarks

The setting is error during the System Lock/warning.

The AGC function can be used only when the output function is the Continuous function and the output mode is AC-INT/AC-VCA/AC-SYNC/DC-INT/DC-VCA.

When an AC voltage waveform other than SIN is selected, the AGC function cannot be enabled.

4.2.2.44 Set Output Correction Function: Enable/Disable Autocal Function

:OUTPut:ACALibration

Description

Sets/gets the Autocal

Setting parameter

<state> ::= <BOL>

<BOL> → 0/OFF: Disable, 1/ON: Enable

Query parameter

None

Response format

<NBOL>

Setting example

OUTP:ACAL ON

Query example

OUTP:ACAL?

Response example

1

Remarks

The setting is error during the System Lock/warning.

The Autocal function can be used only when the output function is the Continuous function and the output mode is AC-INT/AC-VCA/AC-SYNC/DC-INT/DC-VCA.

When an AC voltage waveform other than SIN is selected, the Autocal function cannot be enabled.

4.2.2.45 Set External Input Signal: Set/Get External Input Gain

:INPut:GAIN

Description

Sets/gets the external input gain

The setting can be made in the following modes:

AC-EXT, AC+DC-EXT, AC-VCA, DC-VCA, AC-ADD, AC+DC-ADD

Setting parameter

<inp gain> | MINimum | MAXimum

<inp gain> ::= <REAL>

<REAL> → External input gain

MINimum → Minimum value

MAXimum → Maximum value

For the setting value range, maximum value, minimum value, and resolution, see the instruction manual of the main unit.

Query parameter

[MINimum | MAXimum]

MINimum → Gets the minimum value

MAXimum → Gets the maximum value

Response format

<NR2>

Setting example

INP:GAIN 10

Query example

INP:GAIN?

Response example

10.0

Remarks

The setting is error during the System Lock/warning.

4.2.2.46 Set External Input Signal: Set/Get External Synchronization Signal Source

:INPut:SYNC:SOURce

Description

Sets/gets the external synchronization signal source

The setting can be made in the AC-SYNC and AC+DC-SYNC modes

Setting parameter

<cloc> ::= <DISC>

<DISC> ::= LINE | EXT

LINE → Line synchronization

EXT → External synchronization

Query parameter

None

Response format

<DISC>

Setting example

INP:SYNC:SOUR EXT

Query example

INP:SYNC:SOUR?

Response example

EXT

Remarks

The setting is error during the System Lock/warning.

The setting cannot be done during the output on.

4.2.2.47 Set External Control Signal: Permit/Inhibit External Control Input

:SYSTem:CONFigure:EXTio[:STATe]

Description

Sets/gets the external control input

Note that the external control input is ignored in the Remote state.

Setting parameter

<state> ::= <INT>

<INT> → 0: Disable, 1: Enable

Query parameter

None

Response format

<INT>

Setting example

SYST:CONF:EXT 1

Query example

SYST:CONF:EXT?

Response example

1

Remarks

The setting is error during the System Lock/warning.

4.2.2.48 Set External Control Signal: Set/Get External Control Output Polarity

:SYSTem:CONFigure:EXTio:POLarity

Description

Sets/gets the external control output polarity

Setting parameter

<polarity> ::= <DISC>

<DISC> ::= POSitive | NEGative

POSitive → Positive logic

NEGative → Negative logic

Query parameter

None

Response format

<DISC>

Setting example

SYST:CONF:EXT:POL POSITIVE

Query example

SYST:CONF:EXT:POL?

Response example

POS

Remarks

The setting is error during the System Lock/warning.

4.2.2.49 Output Setting (for All Phases): Enable/disable Soft Start Function

:OUTPut:SSTart[:STATe][:RISE]

Description

Sets/gets whether to enable/disable soft start function.

Setting parameter

<state> ::= <BOL>

<BOL> → 0/OFF: Disable, 1/ON: Enable

Query parameter

None

Response format

<NBOL>

Setting example

OUTP:SST ON

Query example

OUTP:SST?

Response example

1

Remarks

The setting is error during the System Lock/warning.

The setting can be made only in the AC-INT, AC-SYNC, ACDC_INT, ACDC-SYNC, and DC-INT modes.

The setting cannot be done if output on phase is other than 0.

4.2.2.50 Output Setting (for All Phases): Set/get Soft Start Time

:OUTPut:SSTart:TIME[:RISE]

Description

Set/get soft start time[s].

Setting parameter

<time> | MINimum | MAXimum

<time> ::= <REAL>

<REAL> → soft start time: 0.1 to 30.0 Resolution 0.1

MINimum → 0.1

MAXimum → 30.0

Query parameter

[MINimum | MAXimum]

MINimum → Gets the minimum value

MAXimum → Gets the maximum value

Response format

<REAL>

Setting example

OUTP:SST:TIME 5

Query example

OUTP:SST:TIME?

Response example

5.0

Remarks

The setting is error during the System Lock/warning.

4.2.2.51 Output Setting (for All Phases): Enable/disable Soft Stop Function

:OUTPut:SSTart[:STATe]:FALL

Description

Sets/gets whether to enable/disable soft stop function.

Setting parameter

<state> ::= <BOL>

<BOL> → 0/OFF: Disable, 1/ON: Enable

Query parameter

None

Response format

<NBOL>

Setting example

OUTP:SST:FALL ON

Query example

OUTP:SST:FALL?

Response example

1

Remarks

The setting is error during the System Lock/warning.

The setting can be made only in the AC-INT, AC-SYNC, ACDC-INT, ACDC-SYNC, and DC-INT modes.

The setting cannot be done if output off phase is enable.

4.2.2.52 Output Setting (for All Phases): Set/get Soft Stop Time

:OUTPut:SSTart:TIME:FALL

Description

Set/get soft stop time[s].

Setting parameter

<time> | MINimum | MAXimum

<time> ::= <REAL>

<REAL> → soft stop time: 0.1 to 30.0 Resolution 0.1

MINimum → 0.1

MAXimum → 30.0

Query parameter

[MINimum | MAXimum]

MINimum → Gets the minimum value

MAXimum → Gets the maximum value

Response format

<REAL>

Setting example

OUTP:SST:TIME:FALL 5

Query example

OUTP:SST:TIME:FALL?

Response example

5.0

Remarks

The setting is error during the System Lock/warning.

4.2.3 EPO Commands

4.2.3.1 Set/get the output on/off

OUT

Description

Set/get the output on/off

Setting parameter

<state> ::= <INT>

<INT> → 0: Output off, 1:Output on

Query parameter

None

Response format

<NR1>

Setting example

OUT 1

Query example

?OUT

Response example

1

Remarks

The setting is error during the System Lock/warning.

4.2.3.2 Set/get precision mode or high stability mode

PRC

Description

There is no corresponding function for KP2000AS.

This command is defined for command syntax compatibility with the EPO series.

This command retains the set value and returns the retained value when querying.

*RST returns to the initial value.

Setting parameter

<state> ::= <INT>

<BOL> → 0: High stability mode, 1:Precision mode

Query parameter

None

Response format

<NR1>

Setting example

PRC 1

Query example

?PRC

Response example

1

Remarks

The setting cannot be done during the output on.

The initial value is 1: Precision mode.

Returns the currently set value for inquiries regardless of the AC/DC mode or signal source setting.

4.2.3.3 Set/get the AC/DC voltage mode

DCM

Description

Set/get the AC/DC voltage mode

Setting parameter

<state> ::= <INT>

<INT> → 0: AC voltage mode(AC-INT), 1:DC voltage mode(DC-INT)

Query parameter

None

Response format

<NR1>

Setting example

DCM 0

Query example

?DCM

Response example

0

Remarks

The setting is error during the System Lock/warning.

The setting cannot be done during the output on.

If KP2000AS is other than AC-INT or DC-INT, the query returns -1.

4.2.3.4 Set/get the output AC range or DC range

RNG

Description

Set/get the output AC range or DC range

Setting parameter

<state> ::= <INT>

<INT> → 0: 100V range, 1: 200V range

Query parameter

None

Response format

<NR1>

Setting example

RNG 1

Query example

?RNG

Response example

1

Remarks

The setting is error during the System Lock/warning.

The setting cannot be done during the output on.

When querying, the current range value is returned regardless of ACDC mode.

4.2.3.5 Set/get the start phase

SPH

Description

Set/get the start phase

Setting parameter

<phase> ::= <INT>

<INT> → 0 : 0.0 deg
1 : 90.0 deg
2 : 180.0 deg
3 : 270.0 deg

Query parameter

None

Response format

<NR1>

Setting example

SPH 1

Query example

?SPH

Response example

1

Remarks

The setting is error during the System Lock/warning.

Cannot be set in AC-EXT, ACDC-EXT, DC-INT, or DC-VCA mode.

In AC-EXT, ACDC-EXT, DC-INT, and DC-VCA modes, the query returns 0.

If the setting parameter is set other than the above, the query returns -1.

4.2.3.6 Set/get the frequency

FRQ

Description

Set/get the frequency.

Setting parameter

<frequency> ::= <REAL>

<REAL> → Frequency: The range that can be used are as follows.

40.00 to 550.0 (AC)

1.00 to 550.0 (ACDC)

Resolution 0.01(<100Hz), 0.1(<1000Hz)

Query parameter

None

Response format

<NR2>

Setting example

FRQ 50.00

Query example

?FRQ

Response example

50.00

Remarks

The setting is error during the System Lock/warning.

Cannot be set in the following modes:

AC-SYNC, AC-EXT, ACDC-SYNC, ACDC-EXT

DC-INT, DC-VCA

4.2.3.7 Set/get the upper limit value of the frequency setting range limit

FUP

Description

Set/get the upper limit value of the frequency setting range limit.

Setting parameter

<frequency> ::= <REAL>

<REAL> → Frequency: The range that can be used are as follows.

40.00 to 550.0 (AC)

1.00 to 550.0 (ACDC)

Resolution 0.01(<100Hz), 0.1(<1000Hz)

Query parameter

None

Response format

<NR2>

Setting example

FUP 60.00

Query example

?FUP

Response example

60.00

Remarks

The setting is error during the System Lock/warning.

Cannot be set in the following modes:

AC-SYNC, AC-EXT, ACDC-SYNC, ACDC-EXT

DC-INT, DC-VCA

4.2.3.8 Set/get the lower limit value of the frequency setting range limit

FLW

Description

Set/get the lower limit value of the frequency setting range limit.

Setting parameter

<frequency> ::= <REAL>

<REAL> → Frequency: The range that can be used are as follows.

40.00 to 550.0 (AC)

1.00 to 550.0 (ACDC)

Resolution 0.01(<100Hz), 0.1(<1000Hz)

Query parameter

None

Response format

<NR2>

Setting example

FLW 50.00

Query example

?FLW

Response example

50.00

Remarks

The setting is error during the System Lock/warning.

Cannot be set in the following modes:

AC-SYNC, AC-EXT, ACDC-SYNC, ACDC-EXT

DC-INT, DC-VCA

4.2.3.9 Set/Get AC or DC output voltage

VLT

Description

Set/Get AC or DC output voltage.

Setting parameter

<volt> ::= <REAL>

<REAL> →If AC mode : AC output voltage, If DC mode : DC output voltage

For the setting value range, maximum value, minimum value, and resolution, see the instruction manual of the main unit.

Query parameter

None

Response format

<NR2>

Setting example

VLT 100.0

Query example

?VLT

Response example

100.0

Remarks

The setting is error during the System Lock/warning.

Cannot be set in the following modes.

AC-VCA, AC-EXT, ACDC-INT, ACDC-SYNC, ACDC-ADD, ACDC-EXT, and DC-VCA.

If query:

AC-INT, AC-VCA, and AC-EXT return the current AC voltage value setting in AC mode.

In ACDC-INT, ACDC-SYNC, ACDC-ADD, and ACDC-EXT

returns the current setting of the AC output voltage value in ACDC mode.

DC-INT and DC-VCA return the DC voltage value in DC mode.

4.2.3.10 Set/get the AC or DC voltage setting limit

VUP

Description

Set/get the AC or DC voltage setting limit.

Setting parameter

<volt> ::= <REAL>

<REAL> → If AC mode : AC output voltage limit,
If DC mode : DC output voltage limit

For the setting value range, maximum value, minimum value, and resolution, see the instruction manual of the main unit.

Query parameter

None

Response format

<NR2>

Setting example

VUP 100.0

Query example

?VUP

Response example

100.0

Remarks

The setting is error during the System Lock/warning.

Cannot be set in the following modes.

AC-VCA, AC-EXT, ACDC-INT, ACDC-SYNC, ACDC-ADD, ACDC-EXT, and DC-VCA.

If query:

AC-INT, AC-VCA, and AC-EXT return the upper RMS voltage limit for AC mode.

In ACDC-INT, ACDC-SYNC, ACDC-ADD, and ACDC-EXT returns the current setting of the peak value voltage upper limit in ACDC mode.

For DC-INT and DC-VCA, the peak value voltage upper limit for DC mode is returned.

5.Programming Sample

5.1 KP2000AS Control Programming

This section explains how to remote-control the KP2000AS from the personal computer through the USB interface.

This section assumes an understanding of the VISA (Virtual Instrument System Architecture) programming interface and programming language supported by the VISA library.

This program is checking the operation in the following environment.

VISA library : National Instruments' NI-VISA.net 23.3 Library.
Programming Environment: Microsoft Visual Studio 2015 .Net Framework 4.8 with C# language

This section describes:

a) Continuous output setting

Switch the output function mode to Continuous, make the output setting, then turn on the output. After that, use the measurement function to read the measured output value.

b) Obtain status register

After setting the warning status transition filter and the warning event enable register, obtain the status byte to check for the warning state.

These explanations are intended for helping you understand the remote command control procedure, and thus omit general programming considerations such as error detection processing and variable initialization processing.
For the VISA library installation, see the document from the VISA library distributors.

5.2 Continuous Function Setting

```
using System;
using System.Windows.Forms;
using System.Linq;

// <Process flow>
// ■Initialize the communication state.
// NameSpace declaration of NI-VISA library
using Ivi.Visa;
using NationalInstruments.Visa;

// Search for KP2000AS using the resource string
// Generate the VISA session of the NI-VISA library
// Use the VISA session to specify the KP2000AS serial number and
// establish the communication session with the KP2000AS.
// In your program, write the exception handling.
// Use catch to write the error handling when communication session is established.
// Whenever an error occurs, NI-VISA library throws it to the exception.
//
System.Collections.Generic.IEnumerable<string> strResNames;
ResourceManager rm;
rm = new ResourceManager();
strResNames = rm.Find("USB0::0x0D4A::0x0081::0000000::INSTR");

IMessageBasedSession dp;
dp = (MessageBasedSession)rm.Open(strResNames.ElementAt(0));

// Set to Terminator LF(=0x0a)
dp.TerminationCharacter = 0x0A;

// Set to the Remote State
new UsbSession(dp.ResourceName).SendRemoteLocalCommand(RemoteLocalMode.Remote);

// Clear the device
dp.Clear();

// Clear the error status
dp.RawIO.Write("*CLS\n");
System.Threading.Thread.Sleep(1000);
```

```
// ■Return the KP2000AS to the initial state just after the startup.
// Return the output setting to the state just after the startup.
dp.RawIO.Write("*RST\n");
System.Threading.Thread.Sleep(1000);

// ■Set the output function to Continuous.
dp.RawIO.Write(":SYSTem:CONFigure:MODE CONTinuous\n");
System.Threading.Thread.Sleep(1000);

// ■Set the output mode.
dp.RawIO.Write(":SOURce:MODE AC_INT\n");
System.Threading.Thread.Sleep(1000);

// ■Set the output range.
dp.RawIO.Write(":SOURce:VOLTage:RANGe R100V\n");
System.Threading.Thread.Sleep(1000);

// ■Set the output waveform.
dp.RawIO.Write(":SOURce:FUNCtion:SHAPe:IMMediate SIN\n");
System.Threading.Thread.Sleep(1000);

// ■Set the output frequency.
dp.RawIO.Write(":SOURce:FREQuency:IMMediate 50.00\n");
System.Threading.Thread.Sleep(1000);

// ■Set the output voltage.
dp.RawIO.Write(":SOURce:VOLTage:LEVel:IMMediate:AMPLitude 100.0\n");
System.Threading.Thread.Sleep(1000);

// ■Turn on the output.
dp.RawIO.Write(":OUTPut:STATe ON\n");
System.Threading.Thread.Sleep(1000);

// ■Obtain the measured output voltage value.
string strMeasureVoltageRMS = "";
dp.RawIO.Write(":MEASure:SCALar:VOLTage:RMS?\n");
strMeasureVoltageRMS = dp.RawIO.ReadString();

// ■Obtain the measured output current value.
string strMeasureCurrentRMS = "";
dp.RawIO.Write(":MEASure:SCALar:CURRent:RMS?\n");
strMeasureCurrentRMS = dp.RawIO.ReadString();
```

```
// ■Turn off the output.
dp.RawIO.Write(":OUTPut:STATe OFF\n");
System.Threading.Thread.Sleep(1000);

// Clear the Remote state
new UsbSession(dp.ResourceName).SendRemoteLocalCommand(RemoteLocalMode.Local);

// ■Terminate the communication and release the session.
dp.Dispose();
```

5.3 Obtain Status Register

```
using System;
using System.Windows.Forms;
using System.Linq;

// <Process flow>
// ■Initialize the communication state.
// NameSpace declaration of NI-VISA library
using Ivi.Visa;
using NationalInstruments.Visa;
// Search for KP2000AS using the resource string
// Generate the VISA session of the NI-VISA library
// Use the VISA session to specify the KP2000AS serial number and
// establish the communication session with the KP2000AS.
// In your program, write the exception handling.
// Use catch to write the error handling when communication session is established.
// Whenever an error occurs, NI-VISA library throws it to the exception.
//
System.Collections.Generic.IEnumerable<string> strResNames;
ResourceManager rm;
rm = new ResourceManager();
strResNames = rm.Find("USB0::0x0D4A::0x0081::0000000::INSTR");

IMessageBasedSession dp;
dp = (MessageBasedSession)rm.Open(strResNames.ElementAt(0));

// Set to Terminator LF(=0x0a)
dp.TerminationCharacter = 0x0A;

// Set to the Remote State
new UsbSession(dp.ResourceName).SendRemoteLocalCommand(RemoteLocalMode.Remote);

// Clear the device
dp.Clear();

// Clear the error status
dp.RawIO.Write("*CLS\n");
System.Threading.Thread.Sleep(1000);

// Set the warning transition filter (positive logic)
```

```
dp.RawIO.Write(":STATus:WARNing:PTRansition 65535\n");
System.Threading.Thread.Sleep(1000);

// Set permission of the warning event register
dp.RawIO.Write(":STATus:WARNing:ENABle 65535\n");
System.Threading.Thread.Sleep(1000);

// ■Obtain the status byte to check if the warning state is detected

// ReadStatusByte() needs to be repeatedly queried in order to detect the change
// in each bit of the register.
// In actual programming, the status byte is acquired by worker-threading or
// other means.

StatusByteFlags sbFlag = 0;
sbFlag = dp.ReadStatusByte();
short sFlag = (short)sbFlag;

// Status changes
if (sFlag != 0)
{
        // Is the warning register detected?
        if ((sFlag & 2) == 2)
        {
            // Obtain the warning state
            string strWarn = "";
            dp.RawIO.Write(":STATus:WARNing:CONDition?\n");
            strWarn=dp.RawIO.ReadString();
           System.Threading.Thread.Sleep(1000);

            // Release the warning
            // This also clears the warning screen display on the KP2000AS.
            dp.RawIO.Write(":SYSTem:WRELease\n");
            System.Threading.Thread.Sleep(1000);
        }
}
// Clear the Remote state
new UsbSession(dp.ResourceName).SendRemoteLocalCommand(RemoteLocalMode.Local);

// ■Terminate the communication and release the session.
dp.Dispose();
```

5.4 Cautions in Programming

a) When a program command send from the computer is interrupted on the way, an error may occur in the next program command. If there was an interruption on the way, perform the device clear.

b) When the computer interrupts receiving on the way after the computer sent a query message then data transfer was started with the KP2000AS specified as talker, the KP2000AS may freeze awaiting for send. If there was an interruption on the way, perform the device clear.

c) After the computer sent a query message, if the computer sends another query message without specifying the KP2000AS as talker, the response to the first query may be returned with the trailing response to the next one (without delimiter).

When the KP2000AS does not work as talker after a query message is sent, perform the device clear.

6.Error Message List

6.1 Error Message List

Table 6.1 shows the list of error messages.

Table 6.1 Error Message List

ID	Message	Meaning
0	No error	There is no error.
-100	Command error	An illegal command was received.
-102	Syntax error	An undefined command or parameter was received.
-103	Invalid separator	An illegal separator was received.
-104	Data type error	The received command or parameter was undefined, and thus was recognized as an illegal command.
-108	Parameter not allowed	There are too many parameters.
-109	Missing parameter	One or more parameters are missing.
-110	Command header error	There is an error in the command header.
-111	Header separator error	There is an error in the keyword separator of the command header.
-113	Undefined header	The received string contains an invalid header.
-120	Numeric data error	There is an error in the numerical parameter.
-130	Suffix error	There is an error in the suffix of the numerical parameter.
-140	Character data error	There is an error in the discrete parameter.
-144	Character data too long	The discrete parameter is too long.
-150	String data error	There is an error in the string parameter.
-160	Block data error	There is an error in the block parameter.
-200	Execution error	An error was detected during command execution.
-222	Data out of range	A command parameter is out of the valid range.
-300	Device-specific error	This is a device-specific error.
-350	Queue overflow	The error queue overflowed and thus can no longer hold a new error.
-363	Input buffer overrun	The command input buffer overflowed.
-410	Query INTERRUPTED	A new response message entered the output queue, and thus the previous message was lost.
-420	Query UNTERMINATED	The talker was specified, but the output queue has no response message.
-430	Query DEADLOCKED	Send/receive came to a deadlock. Sending is canceled.
-440	Query UNTERMINATED after indefinite response	The response request order is wrong.
2	Invalid in This Output Mode	This output mode does not allow the setting (execution). Change the output mode.
3	Invalid with Output ON	The output on state does not allow the setting (execution). Turn the output off, then set (execute).
4	Invalid with Output OFF	The output off state does not allow the setting (execution). Turn the output on, then set (execute).
5	Busy	The busy state does not allow the setting (execution). Execute after the busy icon disappears.
7	Invalid with Sweep	The soft start or soft stop state does not allows the setting(execution). Please set (execute) after exiting the sweep state.
11	Under Error State	Cannot be set (executed) because it is in a protected state.

13	Auto Cal Disabled	The Autocal setting becomes off because of out of the calibration range.
15	AGC Disabled	The AGC setting becomes off because of out of the calibration range.
20	Invalid	The condition cannot be set (executed).
23	Option not Installed	Setting (execution) is not possible because the option is invalid.
24	USB Memory Unconnected	No USB memory is connected. Connect a USB memory.
25	USB Memory Removed illegally	The USB memory was removed before the eject operation. Perform the eject operation before removing a USB memory.
26	USB Memory Access Error	The USB memory has an access error.
27	Too Many Files	There are too many files in the USB memory. Each folder can contain 500 files or less.
29	Sync Frequency Unlocked	The output cannot be turned on because of not locking to the synchronization frequency.
31	Configure Memory Error	The internal memory has an error.
33	Line Overvoltage	The power input voltage is excessive. Check if the power input is appropriate.
34	Line Undervoltage	The power input voltage is insufficient. Check if the power input is appropriate.
35	Line Frequency Error	The power input frequency is abnormal. Check if the power input is appropriate.
36	Communication Failure Power Unit	There is a communication error between the firmware and the power unit. Cycle the power. If it still occurs, contact the seller (NF Corporation or our agent) from whom you purchased the product.
37	Internal Communication Failure	There is a communication error in the firmware. Cycle the power. If it still occurs, contact the seller (NF Corporation or our agent) from whom you purchased the product.
38	Communication Failure SC	The multi-unit system communication is abnormal. Make sure the System Cable is connected properly.
41	Mismatched Firmware Versions	In the multi-unit system, the main firmware versions of the cabinets do not match.
42	Mismatched Internal Versions	The versions do not match within the KP2000AS. Please update again.
43	Mismatched Pair of HW/SW Versions	The firmware and internal hardware versions do not match. Please update again.
44	Unsupported Power Unit Version	The power unit version is not supported. Please update again.
45	Mismatched Cabinet Connect	In the multi-unit system, the output capacities of the phases do not match.
48	Outyput Overvoltage	An output overvoltage has occurred.
50	Output Overcurrent[RMS]	An output overcurrent[RMS] has occurred.
51	Output Overcurrent[Peak]	An output overcurrent[Peak] has occurred.
52	Power Unit DCPS Error	A PFC error has occurred.
53	Power Unit DCPS Overvoltage	A DC power supply overvoltage has occurred.

54	Power Unit DCPS Undervoltage	A DC power supply undervoltage has occurred.
55	Overheat	Overheating has occurred.
56	Sensing Voltage Error	A sensing voltage error has occurred.
57	Sync Frequency Error	A sync frequency error has occurred.
58	Limiter[RMS]	Output OFF occurred due to effective value limiter.
59	Limiter[Peak]	Output OFF occurred due to peak limiter.
60	Power Unit Internal Error	An error has occurred inside the power unit.
67	Battery Depleted	The built-in battery is exhausted.
68	Current Parameters Rounded	Data with different numbers of connected devices was read.
69	Multi-Unit System Connection Updated	A phase configuration is detected that is different from the previous one.
75	Calibration Data Error in Control Unit	There is an error in the adjustment data. Cycle the power. If it still occurs, contact the seller (NF Corporation or our agent) from whom you purchased the product.
76	Property Data Error in Control Unit	There is an error in the option data. Cycle the power. If it still occurs, contact the seller (NF Corporation or our agent) from whom you purchased the product.
77	USB Memory Connected	USB memory connection was detected.
78	USB Memory Disconnected	USB memory was disconnected.
80	Invalid Character	An invalid character was specified.
84	System Updated Please Reboot	The firmware was updated.
86	System Update Fialed	Firmware update failed.
88	Auxiliary Power Failure	The internal auxiliary power is abnormal.
90	Mismatched System Setting	An inconsistency in system settings between cabinet was detected.
91	Shut Down	Shutdown detected.
92	Power off Detected	A power outage was detected.
93	Power off Waiting	Waiting for power off operation.
95	Memory Data Error	The read memory data is abnormal.
96	Update Data Error	The update data is invalid.
97	Fail with Duplicated FileName	Save the same file name in the USB memory.
98	No update Needed	This is a version that does not require updates.
99	Output Overpower	Overpower protection occurred when multiple cabinet were installed.

7.Specifications

7.1 Interface Functions

Table 7.1 Interface Functions

Function	Subset	Description
Source handshake	SH1	All send handshake functions provided
Acceptor handshake	AH1	All receive handshake functions provided
Talker	T6	Basic talker functions, Talker release by the MLA
Listener	L4	Basic listener functions, Listener release by the MTA
Service request	SR1	All service request functions provided
Remote/Local	RL1	All remote/local functions provided
Parallel poll	PP0	Parallel poll function not provided
Device clear	DC1	All device clear functions provided
Device trigger	DT0	Device trigger function not provided
Controller	C0	Controller function not provided

· RS232 and LAN interface do not correspond to all the above functions.

7.2 GPIB Bus Driver

Table 7.2 Bus Driver Specifications

Data bus	DIO1 to 8	Open collector
Handshake bus	NRFD, NDAC, DAV	Open collector tri-state
Management bus	SRQ EOI	Open collector tri-state

7.3 Code Used

The KP2000AS as the listener can accept ISO 7-bit codes (JIS/ASCII), except when receiving binary data, and ignores MSB of 8-bit data (e.g., parity). Any program codes are interpreted and executed with no case sensitivity. However, the control characters except <CR>, <LF>, and <TAB> (codes from 0 to 8, B, D to 1F, and 7F in hexadecimal) are ignored.

As the talker, it sends ISO 7-bit codes (JIS or ASCII) with no parity except when sending binary data (MSB of 8-bit data = 0). All alphabetical characters in the program code are sent in uppercase.

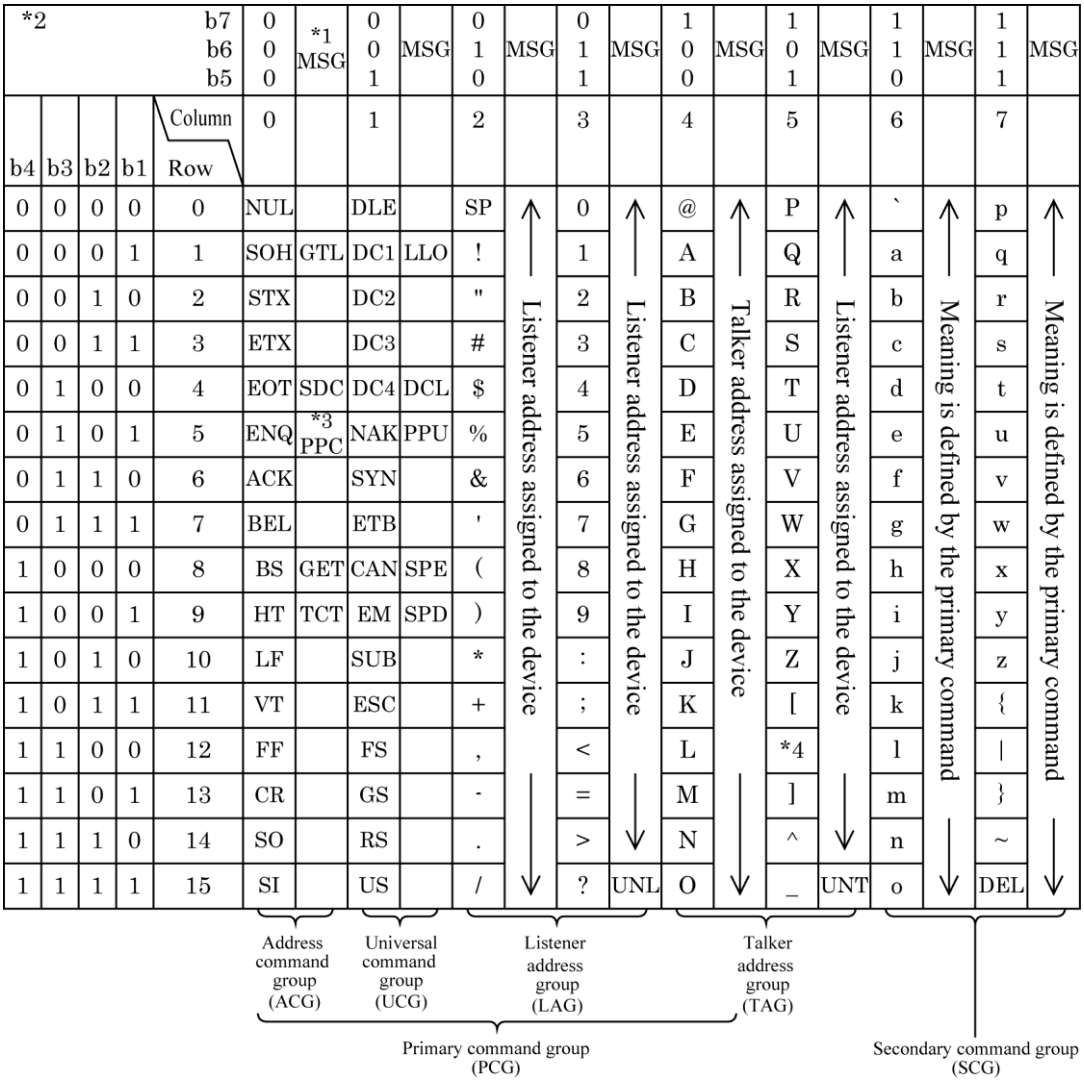
When binary data is sent and received, all 8-bit patterns are valid and the standard IEEE floating point format (including any control codes) is supported.

7.4 Response to Interface Message

Table 7.3 Response to Interface Message

IFC	• Initialize the GPIB interface message. • Release the specified listener or talker.
DCL and SDC	• Clear the I/O buffer for GPIB.
LLO	• Disable the LOCAL key on the panel.
GTL	• Turn to the Local state.

7.5 Multi-Line Interface Message



b4	b3	b2	b1	Row	0	1	2	3	4	5	6	7
0	0	0	0	0	NUL	DLE	SP	0	@	P	`	p
0	0	0	1	1	SOH	GTL	DC1	LLO	!	1	A	Q	a	q
0	0	1	0	2	STX		DC2		"	2	B	R	b	r
0	0	1	1	3	ETX		DC3		#	3	C	S	c	s
0	1	0	0	4	EOT	SDC	DC4	DCL	$	4	D	T	d	t
0	1	0	1	5	ENQ	*3 PPC	NAK	PPU	%	5	E	U	e	u
0	1	1	0	6	ACK		SYN		&	6	F	V	f	v
0	1	1	1	7	BEL		ETB		'	7	G	W	g	w
1	0	0	0	8	BS	GET	CAN	SPE	(	8	H	X	h	x
1	0	0	1	9	HT	TCT	EM	SPD	)	9	I	Y	i	y
1	0	1	0	10	LF		SUB		*	:	J	Z	j	z
1	0	1	1	11	VT		ESC		+	;	K	[	k	{
1	1	0	0	12	FF		FS		,	<	L	*4	l	|
1	1	0	1	13	CR		GS		-	=	M	]	m	}
1	1	1	0	14	SO		RS		.	>	N	^	n	~
1	1	1	1	15	SI		US		/	?	UNL	O	_	UNT	o	DEL

Figure 7.1 Multi-Line Interface Message

Note: *1 MSG means an interface message
*2 b1=DIO1...b7=DIO7. DIO8 is not used
*3 Accompanied by the secondary command
*4 "\" for IEC standard, "¥" for JIS

GTL : Go To Local
SDC : Selected Device Clear
PPC : Parallel Poll Configure
GET : Group Execute Trigger
TCT : Take Control
LLO : Local Lockout
DCL : Device Clear
PPU : Parallel Poll Unconfigure
SPE : Serial Poll Enable
SPD : Serial Poll Disable
UNL : Unlisten
UNT : Untalk

WABUN: (DA00104979)

NOTES

- Reproduction of the contents of this manual is forbidden by applicable laws.
- The contents of this manual may be revised without notice.
- Information provided in this manual is intended to be accurate and reliable. However, we assume no responsibility for any damage regarding the contents of this manual.
- Should you notice any doubtful or wrong statement, or lack of description, please contact us or our agent.

Programmable AC/DC Power Source KP2000AS
Instruction Manual
(Remote Control)

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