6. REMOTE PROGRAMMING

This chapter provides an overview of the GPIB Interface and describes the connections and settings. This chapter also contains lists of commands for programming and introduces program examples.

6.1 GPIB Command Index

Use the following GPIB command index as the index for GPIB command in Chapter 6.

6.2 GPIB Operation

The R6240A comes with a GPIB (General Purpose Interface Bus) conforming to the IEEE standard 488-1978 as standard enabling remote control from an external controller.

6.2.1 What GPIB Is

GPIB is a high-performance bus for integrating computers measuring instruments.
The GPIB operation is defined by the IEEE Standards 488-1978.
Since GPIB interface has bus structure, each device is specified by assigning a unique address.
Up to 15 devices can be connected to one bus in parallel on the bus. Each GPIB device features one or more of the following functions:

- Talker

  The device specified for sending data to bus is referred to as "talker." Only one device can function as the active talker on the GPIB bus.

- Listener

  Devices specified for receiving data on the bus are referred to as "listeners." The GPIB bus accommodates multiple devices operating as active listeners.

- Controller

  that the device specifying the talker and the listener is referred to as the "controller." Only one device can operate as the active controller on the GPIB bus.
  Those controllers that can control IFC and REN messages are referred to as "system controllers."

Only one system controller it is allowed on one GPIB bus.
If more than one controllers are on the same bus, the system controller becomes the active controller for the system start-up, and other devices with controller capacity function as addressable units.
To make another controller the active controller, the Take Control (TCT) interface message is used.
At this time, the active controller becomes a non-active controller.
The controller controls the entire system by sending interface messages and device messages to each measuring instrument.
These message types have the following functions.

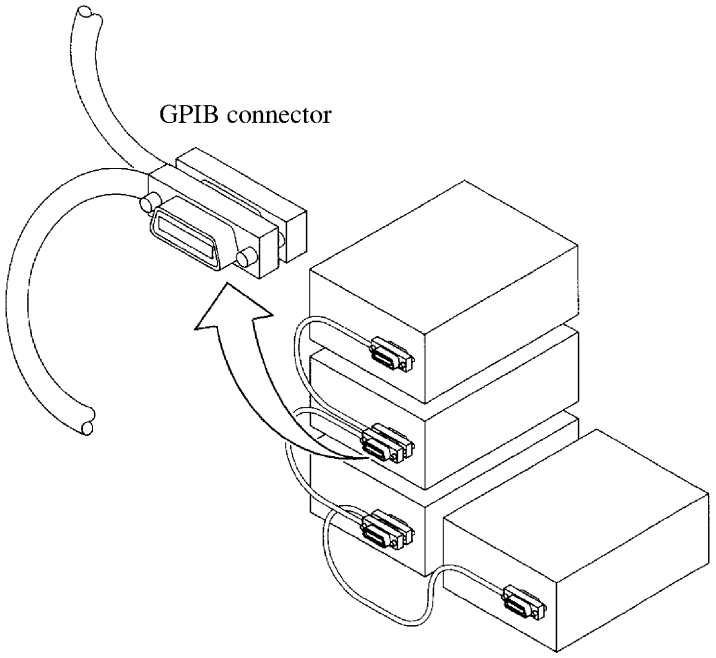
- Interface messages: Control the GPIB bus.
- Device messages: Control measuring instruments.

6.2.2 GPIB Setup

1. GPIB Connection

   The following describes the standard GPIB connection and the precautions for the connection.

   Secure the GPIB connectors with two screws provided to prevent the connectors from coming loose during use.



The precautions for the GPIB interface connection are as follows:

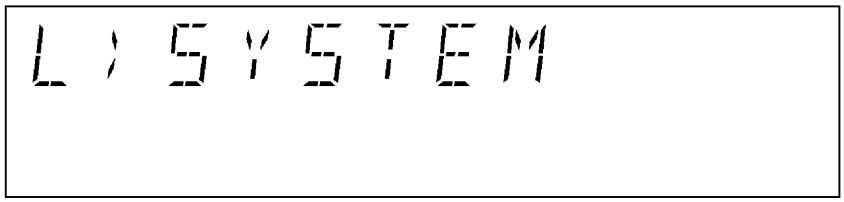
- The total lengths of the GPIB cables used in one bus system must not exceed 20 meters and must not be longer than the 2 m× the number of the connected devices.
  The GPIB controller itself is also counted as one device.
- The maximum number of devices that can be connected to one bus is 15.
- No restrictions are applied for cable connections. However, do not connect 4 or more GPIB connectors on the device.
  Putting 4 or more GPIB connectors on one device will exercise a force upon the mounting section of the connector that could damage the section.

(Example) The total cable length that can be used in a system made up of 5 devices is 10 meters or less (5 units × 2 m/device = 10 m).
Within the range in which the total cable length does not exceed the allowable length, the cable can be arranged freely.
However, when connecting 10 or more devices, cables shorter than 2 meters must be used for some devices because the total cable length must not exceed 20 meters.

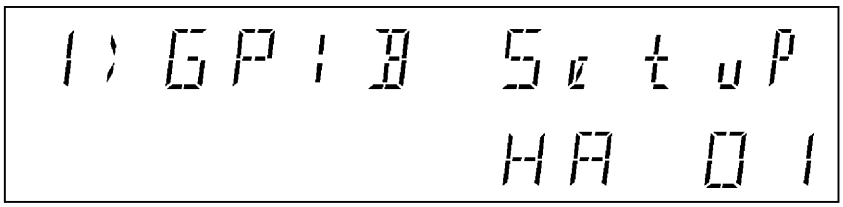
- Connection and removal of GPIB cables must be performed with the power turned OFF, and with the chassis commonly grounded for all the devices connected and to be connected.
- If an ATN request interruption occurs during transfer of messages between devices, the ATN will have priority.
  The previous conditions are cleared.
- When using the system in the talk-only mode, do not connect the controller.
- Retain the REN line at Low for 5 ms or longer following the transmission of program codes.

2. Setting GPIB Address

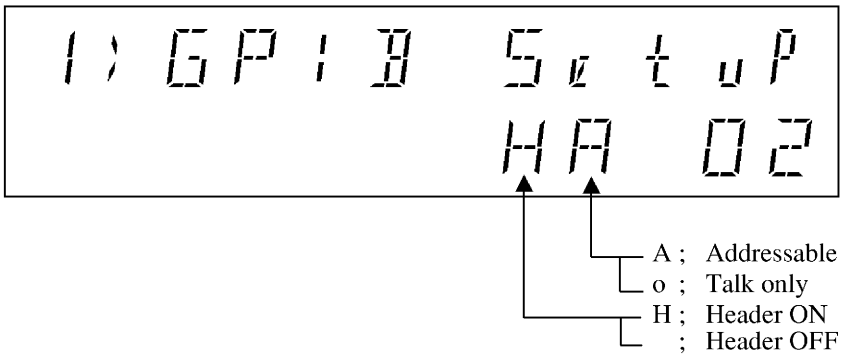
1. Press **MENU** and **4W/2W** (←) or **RCL** (→) to display the following screen.



2. Press **DOWN** (↓).
   The setting screen is displayed as follows.



3. Press △, ▽, or **123...** (direct input mode) to set the address.
   The following shows a display example of changing address from 01 to 02.



4. Press **SEL** key to select the items in Addressable or Header and press △ or ▽ to set them
5. Press **MENU** to display the Home screen.

The GPIB address setting is completed.

6.2.3 GPIB Interface Functions

Code	Description
SH1	With the Source Handshake function.
AH1	With the Acceptor Handshake function.
T5	With the Basic Talker function, Serial Poll function, Talker Clear function specified by the listener, and Talk-Only Mode function.
L4	With the Basic Listener function and Listener Clear function specified by the talker.
SR1	With the Service Request function.
RL1	With the Remote function, Local function, Local -Lock Out function.
PP0	Without the Parallel Poll function.
DC1	With the Device Clear function. (TheSDC and DCL commands can be used.)
DT1	With Device Trigger function (The GET command can be used.)
C0	Without the Controller function.
E2	The three state bus driver can be used.

6.2.4 Response to Interface Messages

The response of the R6240A to the Interface message described in the following are defined by the IEEE standard 488-1978.

For how to send interface messages to the R6240A, refer to the instruction manual for the controller.

1. Interface Clear (IFC)

   This message is sent directly to the R6240A through the signal line.
   The R6240A stops the operations of the GPIB bus by this message.

2. Remote Enable (REN)

   This message is sent directly to the R6240A through the signal line. When the message is true, the R6240A is specified as a listener and is put in the remote status.
   This status continues until REN becomes false or the **LOCAL** key is pressed. When set in local status, the R6240A ignores all the received data.
   In the remote status, all the key inputs are ignored except for the **LOCAL** key.
   In the Local -Lock out status, all the key inputs are ignored.

3. Serial Poll Enable (SPE)

   When the R6240A receives the message from an external source, the R6240A enters the Serial Poll mode.
   In this mode, when the R6240A is specified as a talker, status bytes are transmitted instead of normal messages. The mode continues until the Serial Poll Disable (SPD) message or the IFC message is received.
   When the R6240A is sending the Service Request (SRQ) message to the controller, the response data's bit 6 (RQS bit) becomes 1 (TRUE).

   When the transmission is completed, the RQS bit becomes 0 (FALSE).
   The Service Request (SRQ) message is sent directly through the signal line.

4. Device Clear (DCL)

   When the R6240A receives DCL, the R6240A executes the following.:

   - Clears the input buffer and the output buffer.
   - Resets the parser section, execution control section, response data generation section
   - Cancels all the commands that impede the remote command to be executed next
   - Cancels the commands temporarily stopped because they are waiting for other parameters.

   The following items are not executed:

   - Modification of data set or stored in the R6240A
   - Interruption of, or influence upon, the operation that the R6240A is currently performing.
   - Modification of status bytes except for MAV (MAV becomes 0 as the result of clearing the output buffer).

5. Selected Device Clear (SDC)

   Performs the same operation as DCL. However, SDC can only be executed when the R6240A is a listener. In other cases, this message is ignored.

6. Go To Local (GTL)

   This message sets the R6240A to local status. When the local status is set, all the operation on the front panel are enabled.

7. Local Lock Out (LLO)

   This message sets the R6240A to local lock out status. In this status, when the R6240A is in the remote status, all the operation on the front panel are disabled.

   (In the normal remote status, pressing **LOCAL** key will enable operations on the front panel).

   To set the R6240A to the Local status at this time, use one of the following methods:.

   - Send the GTL message to the R6240A.
   - Make the REN message false. (At this time, the local lockout status is also released.)
   - Turn OFF and ON the power.

6.2.5 Message Exchanging Protocol

The R6240A receives program messages and issues response data from and to the controller and other devices through the GPIB bus.
Program messages include the commands and queries ("query" refers in particular to commands that ask for response data in return). The exchange of these data follows a specific procedure. This procedure is explained in the following.

1. GPIB buffer types

   The R6240A has the following two buffers.

   - Input buffer

     This is a buffer for temporarily storing data for command analysis.
     (It accommodates 255 bytes and input above this generates an error).

     The input buffer is cleared by either of the following methods.

     - Turn ON the power.
     - Executing DCL or SDC.

   - Output buffer

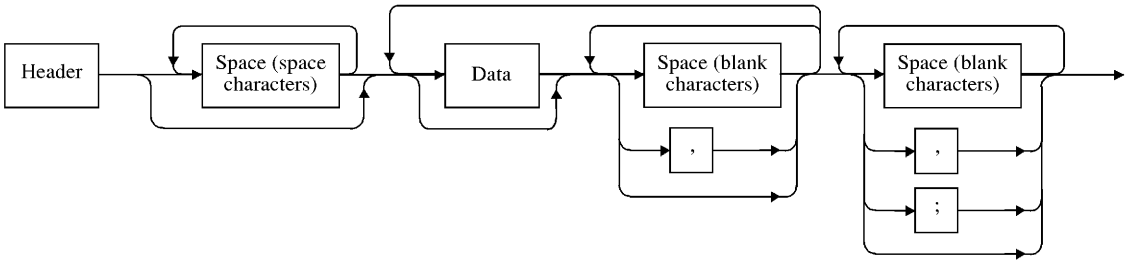
     Buffer for storing data until read from the controller (Accommodates 255 bytes).

     The output buffer is cleared by either of the following methods.

     - Turn ON the power.
     - Executing DCL or SDC

6.2.6 Command Syntax

The command syntax is defined by the following format.



1. Header

   The header normally contains the common command header and the simple header.
   The common command header has an asterisk mark (*) placed in front of the mnemonic.
   The simple headers do not have hierarchical structure and are functionally independent commands.
   Placing a question mark (?) right after the English character in the header makes the command into a query command.

2. Space (blank characters)

   One or more spaces can be used. (Spaces may omit).

3. Data

   If the command requires multiple data sets, data sets are separated by comma (,).
   A space may be used directly before or after comma (,).
   For more information on the data types, refer to Section 6.2.7, “Data Format.”

4. Describing Multiple Commands

   The R6240A allows multiple commands to be described consecutively or separated by semicolon (;), comma (,), or space ( ) on one line.

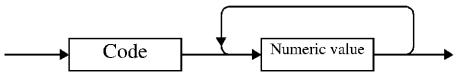
6.2.7 Data Format

The R6240A uses the following data types for input and output of data.

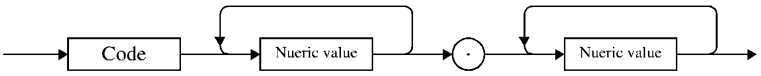
1. Numeric values

   Numeric value formats comprise the following three formats and any format can be used for input to the R6240A.
   Depending on the command, R6240A description is also attached for input.

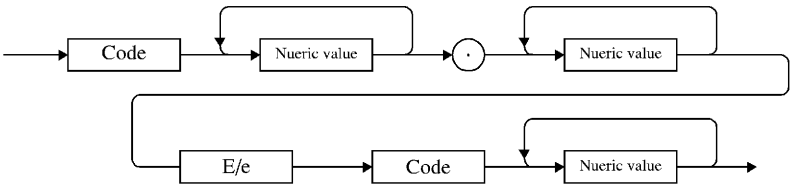
   - Integer type: NR1 format



   - Fixed-point type: NR2 format



   - Floating-point type: NR3 format Code



2. Unit

   A list of the units that can be used for D command is shown below.

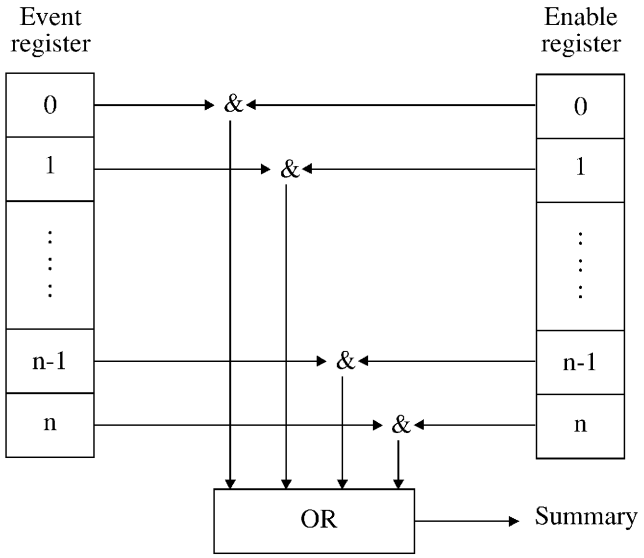
Unit	Exponent	Meaning
V	10^{0}	Voltage
MV	10^{-3}	Voltage
UV	10^{-6}	Voltage
A	10^{0}	Current
MA	10^{-3}	Current
UA	10^{-6}	Current

6.2.8 Status Register Structure

The R6240A has a hierarchical status register structure that conforms to the IEEE standard 488.2-1987 and can send various statuses of the R6240A to the controller.
Following explains an operational model of the status structure and assigning events.

1. Status Register

   The R6240A employs a status register model as defined by the IEEE standard 488.2-1987 that consists of an Event Register and Enable Register.



- Event register

  The event register latches and keeps the status for each event.
  (It may also hold changes).
  Once the register is set, It remains set until it is read out by query or cleared by *CLS.
  Data cannot be written into the Event register.

- Enable register

  The enable register specifies for which bits in the Event Register a valid status summary should be generated.
  The Enable register quires the Event register by AND. and OR of the result is generated.
  The summary is written into the Status Byte Register.
  Data can be written into the Enable Register.

The R6240A has the following 4 types of status registers..

- Status Byte Register (STB)
- Standard Event Status Register (SESR)
- Device Event Status Register (DESR)
- Error Event Register (ERR)

Figure 6-1 below shows the R6240A status register structure.

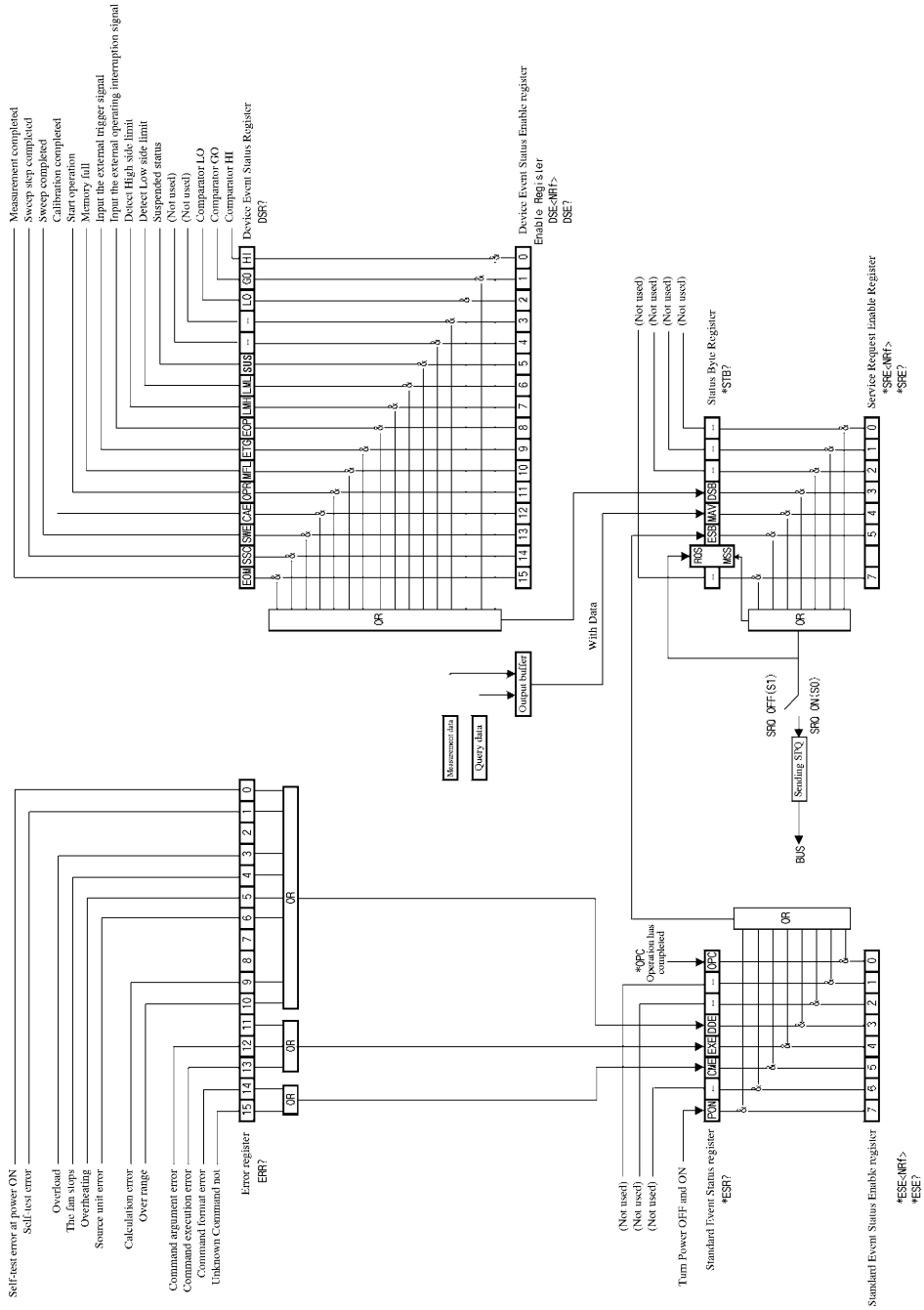


Figure 6-1 Structure of Status Register

2. Event Enable Register

   Each Event Register has an Enable Register that decides which bit to be enabled.
   The Enable Register sets the relevant bit in decimal values.

   - Service Request Enable Register setting: *SRE
   - Standard Event Status Enable Register setting: *ESE
   - Device Event Enable Register: DSE

   (Example) Enables only the EOM bit of the Device-Event-register.
   When the EOM bit of the Device -Event -Register is set to 1, the DSB bit of the Status Byte Register is set to 1.
   PRINT @ 8; "DSE32768" (N88BASIC program example)
   OUTPUT 708; "DSE32768" (HP200, 300 series program example)

   (Example) Enables the Status byte register's DSB (Device Event Status Register summary) bit and the ESB (Standard Event Status Register summary) bit.
   When the DSB bit or the ESB bit are set to 1, the Status Byte Register's MSS bit is set to 1.
   PRINT @ 8; "*SRE40" (N88BASIC program example)
   OUTPUT 708; "*SRE40" (HP200, 300 series program example)

3. Status Byte Register

   The Status Byte Register summarizes the information from the Status Register.
   And, this Status Byte Register's summary is transmitted as service request to the controller.
   Consequently, the function of the Status Byte Register is slightly different from that of the Status register structure.
   The Status Byte Register is explained in Following.
   Figure 6-2 below shows the structure of the Status Byte Register.

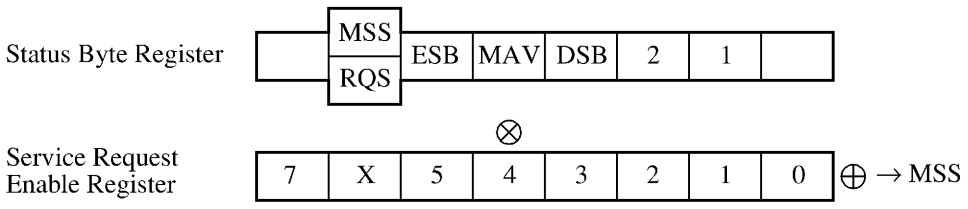


Figure 6-2 Structure of Status Byte Register

The Status Byte Register is similar to the Status Register except for the following 3 points.

- The Summary of the Status Byte Register is written into the bit 6 of the Status Byte Register.
- The Enable Register's bit 6 is always enabled and cannot be unchanged.
- The Status Byte Register's bit 6 (MSS) writes the RQS of the service request.

This register responses to the serial poll from the controller.
When responding to the serial poll, the Status Byte Register's bit 0 to 5, bit 7, and RQS, are read, after which RQS is set to 0.
Other bits are not cleared until their factor become 0.
The Status Byte Register, RQS, and MSS Can be cleared by executing "*CLS." Accompanying this, the SRQ line also becomes False.

Table 6-1 below shows the meaning of each bit of the Status Byte Register.

Table 6-1 Status Byte Register (STB)

bit	Name	Descriptions
0	Not used	Always set to 0
1	Not used	Always set to 0
2	Not used	Always set to 0
3	DSB Device Event Status	ON: 1 is set when any of the DESR incidents occur and 1 is set , if the corresponding DESER bit is also 1. OFF: 0 is set when DESR is cleared by reading (DSR?).
4	MAV Message Available	ON: 1 is set when output data is entered in the output buffer. OFF: 0 is set when the output buffer is read and becomes empty.
5	ESB Standard Event Status	ON: 1 is set when any of the SESR incidents occur and 1 is set , if the corresponding SESER bit is also 1. OFF: 0 is set when SESR is cleared by reading (*ESR?).
6	MSS Master Summary	ON: 1 is set when any of the STB incidents occur and 1 is set, if the corresponding SRER bit is 1.
	RQS Request Service	ON: 1 is set when MSS is set to 1, and SRQ is generated. OFF: When STB is read by the Serial poll.
7	Not used	Always set to 0

Common conditions on which the Status Byte Register is cleared.

- Every bit is cleared when the power is turned ON.
- *CLS clears every bit except that MAV is not cleared if data exists in the output buffer.
- When all the bits in DSB, MAV, and ESB are cleared
- Not cleared even if read by *STB?.

Conditions on which the Service Request Enable Register is cleared.

- When the power is turned ON.
- *When the *SRE0 command is executed.

4. Standard Event Status Register

Table 6-2 below shows the functions assigned to the Standard Event Status Register.

Table 6-2 Standard Event Status Register (ESR)

bit	Name	Descriptions
0	OPC Operation Complete	ON: When all operation is completed after receiving the *OPC command, bit o is set to 1.
1	Not used	Always set to 0
2	Not used	Always set to 0
3	DDE Device Dependent Error	ON: 1 is set when an error related to the hardware occurs.
4	EXE Execution Error	ON: 1 is set when a received command is not executable currently. 1 is set when incorrect data is entered in a command parameter.
5	CME Command Error	ON: 1 is set when the received command is incorrectly spelled.
6	Not used	Always set to 0
7	PON Power On	ON: 1 is set when the power is turned OFF and ON.

Common conditions on which the Standard Event Status Register is cleared.

- Every bit is cleared when the power is turned ON.
- *CLS clears every bit.
- Every bit is cleared when read by *ESR?.

Conditions on which the Standard Event Status Enable Register is cleared.

- When the power is turned ON.
- When the *ESE0 command is executed.

5. Device Event Status Register

Table 6-3 below shows the functions assigned to the Device Event Status Register.

Table 6-3 Device Event Status Register (DSR) (1 of 2)

bit	Name	Contents
0	HI Comparator HI	ON: 1 is set if Comparator calculation result is HI.
1	GO Comparator GO	ON: 1 is set if Comparator calculation result is GO.
2	LO Comparator LO	ON: 1 is set if Comparator calculation result is LO.
3	Not used	Always set to 0
4	Not used	Always set to 0
5	SUS Suspend	ON: 1 is set when the Suspend status is set. OFF: 0 is set when the Operate or Standby status is set.
6	LML Limiter Low	ON: 1 is set when the Low limiter is detected.
7	LMH Limiter High	ON: 1 is set when the High limiter is detected.
8	EOP Ext.Operate Off In	ON: 1 is set when detecting an external operation off signal is detected.
9	ETG Ext.Trigger In	ON: 1 is set when detecting the external trigger signal input is detected.
10	MFL Memory Full	ON: 1 is set when the measurement buffer memory is full. OFF: 0 is set when the measurement buffer Memory becomes not full.
11	OPR Operate	ON: 1 is set when the operating status is set. OFF: 0 is set when the Standby or Suspended status is set.
12	CAE Calibration End	ON: 1 is set when the calibration is completed. OFF: 0 is set when calibration starts.
13	SWE Sweep End	ON: 1 is set when Sweep is completed. OFF: 0 is set when Sweep starts.
14	SSC Sweep Step Complete	ON: 1 is set when the trigger mode is set to HOLD and Sweep step completes(except for the high-speed burst operating status) OFF: 0 is set when Sweep step starts 0 is set when Sweep stops or starts

Table 6-3 Device Event Status Register (DSR) (2 of 2)

bit	Name	Contents
15	EOM End Of Measure	ON: 1 is set when the measurement is completed. OFF: 0 is set when the measurement starts 0 is set when the measurement data is read.

Common conditions on which the Device Event Status Register is cleared

- Every bit is cleared when the power is turned ON.
- *CLS clears every bit.
- Every bit is cleared when Read by DSR?.

Common conditions on which the Device Event Status Enable Register is cleared

- When the power is turned ON.
- When the DSE0 command is executed.

6. Error Register

Table 6-4 below shows the functions assigned the Error register.

Table 6-4 Error Register (ERR)

bit	Contents
0	ON: 1 is set when the power is turned ON and a self-test error occurs
1	ON: 1 is set when the self-test error occurs.
2	Always set to 0.
3	ON: 1 is set when overload is detected. 0 is not set after overload is cleared.
4	ON: 1 is set when the program detects that the fan has stopped. 0 is not set after the status in which the fan has stopped is cleared.
5	ON: 1 is set when overheating is detected. 0 is not set after the overheating status is cleared.
6	ON: 1 is set when a source unit abnormality is detected.
7	Always set to 0
8	Always set to 0
9	ON: 1 is set when a calculation error occurs.
10	ON: 1 is set when an over range occurs.
11	Always set to 0
12	ON: 1 is set when a remote command argument error occurs.
13	ON: 1 is set when a remote command execution error occurs.
14	ON: 1 is set when a remote command syntax error occurs.
15	ON: 1 is set when receiving an unknown remote command.

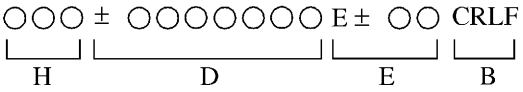
Common conditions on which the Error Register is cleared.

- Every bit is cleared when the power is turned ON.
- *CLS clears every bit.

NOTE: ***The Error Register is not cleared if read by ERR?.***

6.2.9 Data Output Format (Talker Format)

The measurement data and the measurement data memory (RECALL) is read out as the following format.



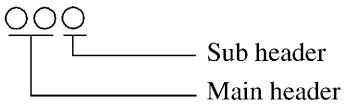
H: Header (Main header characters + Sub header of 1 character)

D: Fixed-point part (polarity + 6 digit decimal figures)

E: Exponent part (E + polarity + 2 digit figures)

B: Block delimiter

1. Header



The header is not output if it is set to OFF.

- Main header

  DV: DC voltage measurement

  DI: DC current measurement

  RM: DC current measurement (resistance displayed)

  EE: Not data in the specified measurement memory

- Sub header

High ▲ U: High limit
B: Low limit
O: Range over
Z: For resistance measurement, set the voltage-source value to 0 (zero)
F: For measuring the resistance, the current-source value is below 20 counts
Priority or current-measurement value is below 200 counts
E: Operation error (scaling function or total function)
H: The comparison operation result is HI
G: The comparison operation result is GO
L: The comparison operation result is LO
C: Scaling operation data
N: NULL operation data
Low ▼ : Others (space output)

2. Fixed-point part and Exponent part

The exponent column in the list below shows the cases that Scaling operation are not performed.

Measurement function			Unit display			
			Decimal number and unit symbol form		Exponent form	
			Fixed-point part	Exponent part	Fixed-point part	Exponent part
DC voltage measurement	Measurement range	3 V	±d.ddddd	E+00	±d.ddddd	E+00
		15 V	±dd.dddd	E+00		E+01
DC current measurement		3 mA	±d.ddddd	E-03		E-03
		30 mA	±dd.dddd	E-03		E-02
		300 mA	±ddd.ddd	E-03		E-01
		1 A	±d.ddddd	E+00		E+00
		4 A	±d.ddddd	E+00		E+00
Resistance measurement	Available digits	1 digit	±0000.0d	E-06 to E+06	±00000d.	E-08 to E+06
			±00000.d			
			±00000d.			
		2 digits	±0000.dd		±0000d.d	E-07 to E+07
			±0000d.d			
			±0000dd.			
		3 digits	±000d.dd		±000d.dd	E-06 to E+08
			±000dd.d			
			±000ddd.			
		4 digits	±00d.ddd		±00d.ddd	
			±00dd.dd			
			±00ddd.d			
		5 digits	±0d.dddd		±0d.dddd	
			±0dd.ddd			
			±0ddd.dd			

Measurement function	Unit display			
	Decimal number and unit symbol form		Exponent form	
	Fixed-point part	Exponent part	Fixed-point part	Exponent part
Detects High limit during the resistance measurement*1	+9.99999	E+37	+9.99999	E+37
Detects Low limit during the resistance measurement*1	+9.99999	E+36	+9.99999	E+36
± Range over	±9.99999	E+35	±9.99999	E+35
IS is below 20 counts, or IM is below 200 counts*1	+9.99999	E+34	+9.99999	E+34
VS is set 0 (zero)*1	+9.99999	E+33	+9.99999	E+33
± Scaling error	±9.99999	E+32	±9.99999	E+32
± TOTAL error	±9.99999	E+31	±9.99999	E+31
Data is not stored when recalling*2	+8.88888	E+30	+8.88888	E+30

*1: This may be detected when measuring the resistance.
*2: There is no data found when reading out measurement buffer memory data.

3. Block delimiter

Output the block delimiter to show the end of data.
There are commands that can specify a block delimiter.

Block delimiter	Commands for setting	Default
CR LF+EOI	DL0	○
LF	DL1	
EOI	DL2	
LF+EOI	DL3	

6.3 GPIB Command

6.3.1 GPIB Command List

1. The Default column shows an item which is initialized at Power ON or at factory shipment.
   - The Power ON column show the status when power is ON.
   - *RST and RINI command initialize values to the default.

     However, the RINI command cannot initialize *5 and *6; the *RST command cannot initialize *6.
2. Note for description in the command list
   - The parameter in [ ] can be omitted.
   - The parameter in < > is one divided data.
   - △ in the Operation column indicates the following.

     During DC or pulse operation and suspension: Accepted only in HOLD or suspend status.

     During seep operation and suspension: Accepted only when sweep-stop or suspend status.

Item		Command	Description	Default		Operation	
				Power ON	Factory shipment	During DC/pulse operation and suspension	During sweep operation and suspension
Source	Source mode	MD0	DC mode		●	×	×
		MD1	Pulse mode				
		MD2	DC Sweep mode				
		MD3	Pulse Sweep mode				
		MD?	Response: MD0 to MD3			○	○
	Source function	VF	Voltage source function		●	Sus-pended when executed	×
		IF	Current source function				
		V?	Response: VF: V4 to V5 IF: I1 to I5			○	○
		I?					
	Source range	SVRX	Optimal range		●	○	×
		SVR4	3 V range				
		SVR5	15 V range				

6.3.1 GPIB Command List

Item		Command	Description	Default		Operation	
				Power ON	Factory shipment	During DC/pulse operation and suspension	During sweep operation and suspension
Source	Source range	SVR?	Response: SVRX4 or SVRX5 (optimal range) SVR4 or SVR5 (fixed range)			○	○
		SIRX	Optimal range		●	○	×
		SIR1	3 mA range				
		SIR2	30 mA range				
		SIR3	300 mA range				
		SIR4	1 A range				
		SIR5	4 A range				
		SIR?	Response: SIRX1 to SIRX5 (optimal range) SIR1 to SIR5 (fixed range)			○	○
	Source value	SOV ±data	Sets voltage source value		0	○	×
		SOI ±data	Sets current source value		0		
		SOV?	Response: SOV± d.ddddE± d *1, *2			○	○
		SOI?	SOI ± d.ddddE ± d			○	○
	Limiter value	LMV ±data1 [,±data2]	Sets voltage limiter value		±15V	○	×
		LMI ±data1 [,±data2]	Sets current limiter value		±1A		
			Both High and Low value can be set for the limiter value • When comparing the data1 and data 2, the larger value is High limiter value and the smaller one is Low limiter value. • Data 2 can be omitted. In this case, +data1 and -data1 are assumed as High limit and Low limit, regardless of the -data1 polarity. ***Note:*** ***1. LMV data1 and data2 can not be set in the same polarity.*** ***2. Set the difference of High limiter value and Low limiter value as 60 digits or over.***				
		LMV?	Response: LMVR ± < hl> ± < ll > *1			○	○
		LMI?	LMIL ± < hl> ± < ll > *1				
			hl: < d. dddE ± d > (High limiter value) ll: < d. dddE ± d > (Low limiter value) *1				

*1: The response decimal point position is different depending on the set value.
For the source value, limiter value, and time parameter setting range, refer to the performance specifications.
*2: Outputs the value that is currently generated or the value that is generated at operation.

Item		Command	Description	Default		Operation	
				Power ON	Factory shipment	During DC/pulse operation and suspension	During sweep operation and suspension
Source	Suspend voltage	SUV ± data	Sets suspend voltage Setting range: 0 to ±15 V		0	○	△
		SUV?	Response: SUV ± d.ddddE ± d *1			○	○
	Suspend Hiz/Loz	SUZ0	Hiz: High resistance output status		●	○	△
		SUZ1	Loz: Low resistance output status				
		SUZ?	Response: SUZ0 or SUZ1			○	○
	Pulse base value	DBV ± data	Voltage pulse base value		0	○	×
		DBI ± data	Current pulse base value		0		
		DBV?	Response: DBV ± d.ddddE ± d *1			○	○
		DBI?	DBI ± d.ddddE ± d				
	Trigger mode	M0	AUTO		●	○	△
		M1	HOLD				
		M?	Response: M0 or M1			○	○
	Operating or Standby	SBY	Output is set to OFF (Standby)	●	●	○	○
		OPR	Output is set to ON (Operate)			○	○
		SUS	Suspends the output (Suspend)			○	○
		SBY?, OPR?, SUS?	Response the present output status. Response: Status: Operating → OPR; Suspended → SUS; Standby → SBY			○	○
	Remote sensing	RS0	2W		●	○	△
		RS1	4W				
		RS?	Response: RS0 or RS1			○	○

*1: The response decimal point is different depending on the set value.
For the source value, limiter value, and time parameter set up range, refer to the performance specifications.

6.3.1 GPIB Command List

Item		Command	Description	Default		Operation	
				Power ON	Factory shipment	During DC/pulse operation and suspension	During sweep operation and suspension
Source	Time parameter	SP Th,Td,Tp[,Tw]	Th: Hold time Td: Measurement Delay Time Tp: Period Tw: Pulse width Unit: ms Tw can be omitted		3 ms 4 ms 50 ms 25 ms	○	△
		SP?	Response: SP<Th>,<Td>,<Tp>,<Tw> Th,Td,Tp,Tw:<d.dddd> *1			○	○
		SD Tds	Tds: Source delay time (unit: ms)		0.03 ms	○	△
		SD?	Response: SDd.dddd *1			○	○
Sweep	Linear Sweep	SN [± st, ± sp, step]	st: Start value sp: Stop value step: Step value (ignores the polarity) If omit all the settings, set sweep type only. However, it is not allowed to omit setting each value separately.		0.1mV/ 0.1µA 10mV/ 10µA 0.1mV/ 0.1µA	○	×
		SN?	Response: SN ± <st>, ± <sp>, <step> *1 st,sp,step: <d.ddddE ± d>			○	○
	Fixed level sweep	SF [± lvl,cnt]	lvl: Level source value cnt: Number of sampling times (1 to 5000) If omit all the settings, set sweep type only. However It is not allowed to omit each value separately.		0 V/0 A 1	○	×
		SF?	Response: SF ± <lvl>,<cnt> *1 lvl: <d.ddddE ± d> cnt: <dddd>			○	○
	Random sweep	SC [st,sp]	st: Start address (0 to 4999) sp: Stop address (0 to 4999) If omit all the settings, set Sweep type only. However it is not allowed to omit each value separately.		0 0	○	△*3
		SC?	Response: SCst,sp st,sp:<dddd>			○	○

*1: The response decimal point is different depending on the set value.
For the source value, limit value, and time parameter set up range, refer to the performance specifications.
*3: The values can be changed only between the start or stop address that was set while it is in the Standby status.

Item		Command	Description	Default		Operation	
				Power ON	Factory shipment	During DC/pulse operation and suspension	During sweep operation and suspension
Sweep	Sweep type	SX?	Responds the sweep type of current source function. Response: Linear sweep: Same as the SN? response Fixed level sweep: Same as the SF? response Random sweep: Same as the SC? response			○	○
	Random sweep memory data	N adr P	Random sweep memory data setting starts from N command and completes at P command. N<adr>,SVR<n>,SOV<data1>,SOV <data2>,...,P (voltage setting) N<adr>,SIR<n>,SOI<data1>,SOI <data2>,...,P (current setting) adr: Memory address (0 to 4999) data1: Voltage or current source value of the adr address data2: Voltage or current source value of the adr+1 address ***Note:*** ***1. If the source range is not specified, optimum value is used.*** ***2. A source value different from the current-source function can not be set.***		0 0 *6	○	×
		N? adr	Response: N<adr>,SVR<n>,SOV ± <data>,P (Voltage-source value) N<adr>,SIR<n>,SOI ± <data>,P (Current-source value) adr: <dddd> n: <d> data: <d.ddddE ± d> *1			○	○
		NP?	Query of the random sweep memory setting status Response: 0... Random sweep memory setting complete 1... Random sweep memory is in setting	0		○	○
		RSAV	Saves the random sweep data			○	×
		RLOD	Loads the random sweep data			○	×
		RCLR	Initializes the random sweep data (Data saved in memory is not initialized)			○	×
	Pulse sweep base value	BS data	data: Pulse sweep base value		0	○	×
		BS?	Response: BS ± <d.ddddE ± d> *1			○	○

*1: The response decimal point is different depending on the set value.
For the source value, limit value, and time parameter set up range, refer to the performance specifications.
*6: The value cannot be initialized by using the RINI or *RST command.

6.3.1 GPIB Command List

Item		Command	Description	Default		Operation	
				Power ON	Factory shipment	During DC/pulse operation and suspension	During sweep operation and suspension
Sweep	Bias value	SB data	data: Bias value		0	○	×
		SB?	Response: SB ± <d.ddddE ± d> *1			○	○
	RTB (Return To Bias)	RB0	OFF (stays at the final output value when sweep is stopped)			○	△
		RB1	ON (returns to bias value when sweep is stopped)		●		
		RB?	Response: RB0 or RB1			○	○
	Sweep range	SR0	Auto		●	○	×
		SR1	Fixed				
		SR?	Response: SR0 or SR1			○	○
	Reverse mode	SV0	OFF		●	○	△
		SV1	ON				
		SV?	Response: SV0 or SV1			○	○
	Number of times sweep is repeated	SS cnt	cnt: Count (0 to 1000) (0 indicates infinite loop)		1	○	△
		SS?	Response: SSdddd			○	○
	Sweep stop	SWSP	Stop sweep			○	○
	Trigger	*TRG	Sweep start trigger Measurement trigger			○	○
Mea-surement	Function	F0	Measurement OFF			○	△
		F1	DC Voltage measurement (DCV)				
		F2	DC current measurement (DCI)		●		
		F3	Resistance measurement (OHM)				
		F?	Response: F0 to F3			○	○
	Measurement range	R0	AUTO range			○	△
		R1	Fixed to the limiter value range		●		
			(However, if the measurement function and the source function is same, the range becomes same as the source range)				
		R?	Response: R0 or R1			○	○

*1: The response decimal point is different depending on the set value.
For the source value, limit value, and time parameter set up range, refer to the performance specifications.

Item		Command	Description	Default		Operation	
				Power ON	Factory shipment	During DC/pulse operation and suspension	During sweep operation and suspension
Mea-surement	Integration time	IT0	100 µs			○	△
		IT1	500 µs				
		IT2	1 ms				
		IT3	5 ms				
		IT4	10 ms				
		IT5	1 PLC		●		
		IT6	100 ms				
		IT7	200 ms				
		IT?	Response: IT0 to IT7			○	○
	Auto zero	AZ0	OFF			○	△
		AZ1	ON		●		
		AZ?	Response: AZ0 or AZ1			○	○
	Switching the unit display	DM0	Displays unit in the decimal number and unit form		●	○	△
		DM1	Displays unit in the exponent form				
		DM?	Response: DM0 or DM1			○	○
	Number of digits displayed for the measurement	RE3	Displays 3 1/2 digits			○	△
		RE4	Displays 4 1/2 digits				
		RE5	Displays 5 1/2 digits		●		
		RE?	Response: RE3 to RE5			○	○
	Measurement buffer memory	ST0	Store OFF	●	●	○*7	△
		ST1	Normal ON				
		ST2	Burst ON			△	
		ST?	Response: ST0 to ST2			○	○
		RL	Initializes the stored data			△	△

*7: Operational only between ST0 and ST1

6.3.1 GPIB Command List

Item		Command	Description	Default		Operation	
				Power ON	Factory shipment	During DC/pulse operation and suspension	During sweep operation and suspension
Measurement	Measurement buffer memory	RN n[,adr]	n: 0... Releases recall execution status	●	●	△	△
			1... Sets recall execution status				
			adr: Recall data number (0 to 4999) (The data number is not changed if this setting is omitted)				
			Reading out the recall data by using the talker function after the recall execution status is set performs the following operation. • Increments the recall data number after the data output • If no data exists in the specified number, the output becomes < EE + 8.88888E + 30 > • Reading out does not erase the data in memory				
		RN?	Response: RNn,adr n: <d> adr: <dddd>			○	○
		SZ?	Reads out the stored data Response: <dddd>	0	*6	○	○
Operation	NULL operation	NL0	OFF		●	○	△
		NL1	ON				
		NL?	Response: NL0 or NL1			○	○
		KNL ± data	Sets Null constant (An error occurs if NULL OFF is set) *4		0	○	△
		KNL?	Response: KNL ± d.ddddE ± dd			○	○
	Comparison operation	CO0	OFF		●	○	△
		CO1	ON				
		CO?	Response: CO0 or CO1			○	○
		KHI ± data	Sets upper limit value		0	○	△
		KLO ± data	Sets lower limit value *4		0		
		KHI?	Response: KHI ± d.ddddE ± dd			○	○
		KLO?	KLO ± d.ddddE ± dd				

*4: The setting range is 0 to ±999.999E + 24.
*6: It is not initialized by RINI or *RST command.

Item		Command	Description	Default		Operation	
				Power ON	Factory shipment	During DC/pulse operation and suspension	During sweep operation and suspension
Opera-tion	Scaling operation	SCL0	OFF		●	○	△
		SCL1	ON				
		SCL?	Response: SCL0 or SCL1			○	○
		KA a	a: A constant (0 (zero) is not available)		1	○	△
		KB b	b: B constant		0		
		KC c	c: C constant		1		
		KA?	Response: KA ± d.ddddE ± dd			○	○
		KB?	KB ± d.ddddE ± dd				
		KC?	KC ± d.ddddE ± dd				
	MAX/ MIN operation	MN0	OFF		●	○	△
		MN1	ON				
		MN?	Response: MN0 or MN1			○	○
		AVE?	Reads out the average value	0			
		MAX?	Reads out the maximum value	-9.99999 E+26			
		MIN?	Reads out the minimum value	+9.99999 E+26			
		TOT?	Reads out the integrated value	0			
		AVN?	Reads out the number of measurement times Response: AVN d.ddddE+dd	0			
System	User parameter	STP0	Saves the set parameter to non-volatile memory area 0			○	△
		STP1	Saves the set parameter to non-volatile memory area 1				
		STP2	Saves the set parameter to non-volatile memory area 2				
		STP3	Saves the set parameter to non-volatile memory area 3				
		SINI	Sets the default values to all the memory areas from 0 to 3				
		RCLP0	Loads the data in the non-volatile memory area 0 as the setting parameter	●		×	×
		RCLP1	Loads the data in the non-volatile memory area 1 as the setting parameter				
		RCLP2	Loads the data in the non-volatile memory area 2 as the setting parameter				
		RCLP3	Loads the data in the non-volatile memory area 3 as the setting parameter				
		RINI	Loads the default value as the setting parameter				

*4: The setting range is from 0 to ±999.999E + 24.

6.3.1 GPIB Command List

Item		Command	Description	Default		Operation	
				Power ON	Factory shipment	During DC/pulse operation and suspension	During sweep operation and suspension
System	Initializing the instrument	*RST	Initializes the parameter (The default values are not mentioned *6 in this table)			○	○
		C	Clears the device			○	○
	Instrument information	*IDN?	Response: The instrument information query command ADVANTEST, R6240A, XXXXXXXXX, YYYYY ADVANTEST: Manufacturer (9 characters) R6240A: Instrument name (6 characters) xxxxxxxxx: Serial number (9 characters) yyyyy: ROM revision number (5 characters)			○	○
	Electrical frequency	Automatic setting				○	○
		LF?	Response: LF0...50 Hz LF1...60 Hz				
	Notice buzzer	NZ0	OFF			○	△
		NZ1	ON		●		
		NZ?	Response: NZ0 or NZ1			○	○
	Comparison operation result buzzer	BZ0	OFF		●	○	△
		BZ1	ON (when the comparison operation result is HI)				
		BZ2	ON (when the comparison operation result is GO)				
		BZ3	ON (when the comparison operation result is LO)				
		BZ4	ON (when the comparison operation result is HI or LO)				
		BZ?	Response: BZ0 to BZ4			○	○
	Limit detection buzzer	UZ0	OFF		●	○	△
		UZ1	ON				
		UZ?	Response: UZ0 or UZ1			○	○
	Self test	*TST?	Executes and reads out the results Response: 0: Pass 1: Fail			×	×
		TER?	Returns self test result of each register Response: a, b, c, and d (a, b, c, and d are equivalent to 0 to 65535)			○	○
	Error log	ERL?	Reads out error description Number of errors and error descriptions are cleared. Response: ± ddd, ± ddd, ± ddd, ± ddd, ± ddd (+ is shown as a space)			○	○
		ERC?	Reads out the number of errors Response: ddd 000: No error 001 to 999: Number of errors (006 to 999: Can be overwritten)			○	○

Item		Command	Description	Default		Operation	
				Power ON	Factory shipment	During DC/pulse operation and suspension	During sweep operation and suspension
System	Interlock setting	OP0	Inputs the STBY In signal (IN)		●		
		OP1	Inputs the OPR/SRBY In signal (IN)				
		OP2	Inputs the Interlock In signal (IN)			×	×
		OP3	Outputs the Operate Out signal (OUT)				
		OP4	Inputs the OPR/SUS In signal (IN)				
		OP?	Response: OP0 to OP4			○	○
	Input and output setting of the synchronous control signal	CP0	Outputs the COMPLETE signal Meas Front (Measurement Start)				
		CP1	Outputs the COMPLETE signal Meas End (Measurement End)		●		
		CP2	Outputs the COMPLETE signal Comp HI (Comparison operation result is HI)				
		CP3	Outputs the COMPLETE signal Comp GO (Comparison operation result is GO)			○	△
		CP4	Outputs the COMPLETE signal Comp LO (Comparison operation result is LO)				
		CP5	Outputs the COMPLETE signal Comp HI or LO (Comparison operation result is HI or LO)				
		CP6	Outputs the Sync Out signal				
		CP?	Response: CP0 to CP6			○	○
		CW0	Specifies the width of the synchronous control signal output width: 10 µs			○	△
		CW1	Specifies the width of the synchronous control signal output width: 100 µs		●		
		CW?	Response: CW0 or CW1			○	○
GPIB	Block delimiter	DL0	CRLF<EOI>	●	*5	○	△
		DL1	LF				
		DL2	<EOI>				
		DL3	LF<EOI>				
		DL?	Response: DL0 to DL3			○	○
	Header output	OH0	OFF			○	△
		OH1	ON		●*6		
		OH?	Response: OH0 or OH1			○	○

*5: The value cannot be initialized by using the RINI command.
*6: It is not initialized by RINI or ÅñRST command.

6.3.1 GPIB Command List

Item		Command	Description	Default		Operation	
				Power ON	Factory shipment	During DC/pulse operation and suspension	During sweep operation and suspension
GPIB	SRQ	S0	ON		*5	○	△
		S1	OFF	●			
		S?	Response: S0 or S1			○	○
	Status	*STB?	Query of the Status Byte register (STB) Response: ddd			○	○
		*SRE	Sets the Service Request Enable register (0 to 255)	0	*6	○	○
		*SRE?	Response: ddd			○	○
		*ESR?	Query of the Standard Event Status register (ESR) Response: ddd			○	○
		*ESE	Sets Standard Event Status Enable register (0 to 255)	0	*6	○	○
		*ESE?	Response: ddd			○	○
		DSR?	Query of the Device Event Status register (DSR) Response: ddddd			○	○
		DSE	Sets the Device Event Status Enable register (0 to 65535)	0	*6	○	○
		DSE?	Response: ddddd			○	○
		ERR?	Query of the Error register description (ERR) Response: ddddd			○	○
		*CLS	Clears the status			○	○
	Operation complete	*OPC	After completing all the operation, set LSB of the Standard Event Status register			○	○
		*OPC?	Response: 1 (after all operation completed)			○	○
		*WAI	Waits until all the operation completed			○	○

*5: It is not initialized by RINI command.
*6: It is not initialized by RINI or *RST command.

Item		Command	Description	Default		Operation	
				Power ON	Factory shipment	During DC/pulse operation and suspension	During sweep operation and suspension
Calibration	Calibration switch	CAL0	OFF (Exits the calibration mode)	●		×	×
		CAL1	ON (Enters the calibration mode)				
		CAL?	Response: CAL0 or CAL1			○	○
	Calibration data	XINI	Initializes the calibration data area (Calibration data in non-volatile memory is not initialized)			×	×
		XWR	Saves the calibration data in the non-volatile memory			×	×
	Executing calibration	XVS	Selects voltage source function calibration			×	×
		XIS	Selects current source function calibration				
		XVLH	Selects voltage limiter (High) calibration				
		XVLL	Selects voltage limiter (Low) calibration				
		XILH	Selects current limiter (High) calibration				
		XILL	Selects current limiter (Low) calibration				
		XVM	Selects voltage measurement function calibration				
		XIM	Selects current measurement function calibration				
	Calibration range	XR1 XR2 XR3 XR4 XR5	Sets the calibration range XR1: - / 3 mA XR2: - / 30 mA XR3: - / 300 mA XR4: 3 V / 1 A XR5: 15 V / 4 A			×	×
	Calibration data	XDAT	Changes to the DMM data input mode			×	×
		XD	Data: Inputs DMM read data				
		XADJ	Changes to the calibration data fine adjustment mode			×	×
		XUP	Fine adjusts the calibration data (UP)				
		XDN	Fine adjusts the calibration data (DOWN)				
		XNXT	Moves on to the next calibration			×	×

6.3.1 GPIB Command List

Commands for maintaining compatibility with previous models

Item		Command	Description	Default		Operation	
				Power ON	Factory shipment	During DC/pulse operation	During sweep operation
Source	Source function and source range	V4	Voltage source function of 3 V range			Suspended when executed	
		V5	Voltage source function of 15 V range				
		I1	Current source function of 3 mA range				
		I2	Current source function of 30 mA range				×
		I3	Current source function of 300 mA range				
		I4	Current source function of 1 A range				
		I5	Current source function of 4 A range				
		V?	Response: V 4, V 5 or I1 to I5			○	○
		I?					
	Source value (pulse value) and limiter value	D ± data UNIT	Source setting is different depending of the units used. With UNIT: Automatically sets the optimal range. Available units: V, mA, and A Without UNIT: Set the current source function and range. If specifying the unit that is different from the current source function, the limiter value will be set as shown below. +data is High limiter value -data is Low limiter value			○	×
		D?	Response: D ± <data1>UNIT,D <data2>UNIT data1: Voltage or current source value <d.ddddE ± d> *1 data2: Voltage or current limiter value (The polarity is space) <0d.dddE ± d> *1 UNIT: V or A ***Note:*** ***If the absolute values of High and Low limits are different, the response becomes D ± d.ddddE ± dUNIT D09.999E + 9 UNIT.***			○	○

<table>
<tr><th colspan="2" rowspan="2">Item</th><th rowspan="2">Command</th><th rowspan="2">Description</th><th colspan="2">Default</th><th colspan="2">Operation</th></tr>
<tr><th>Power ON</th><th>Factory shipment</th><th>During DC/pulse operation</th><th>During sweep operation</th></tr>
<tr><td rowspan="4">Source</td><td rowspan="3">Operating or Standby</td><td>H</td><td>Output is set to OFF (Standby)</td><td rowspan="2">●</td><td rowspan="2"></td><td rowspan="2">○</td><td rowspan="2">○</td></tr>
<tr><td>E</td><td>Output is set to ON (Operating)</td></tr>
<tr><td>E?, H?</td><td>Responds to the current output status
Response:
<table><tr><th>Status</th><th>E?, H?</th></tr><tr><td>Operating</td><td>E</td></tr><tr><td>Suspended</td><td>H</td></tr><tr><td>Standby</td><td>H</td></tr></table></td><td></td><td></td><td>○</td><td>○</td></tr>
<tr><td>Random sweep memory data (using D command)</td><td>N [adr]

P</td><td>The random-sweep memory-data starts from N command and completes at P command.
N<adr>,D<data1><UNIT>,D<data2>
<UNIT>,...,P
adr: Memory address (0 to 4999)
data1: adr address voltage or current-source value
data2: Voltage or Current-source value of the address adr + 1

Note:
1. Not specifying the source range goes the FIT range.
2. The source different from the current-source function can not be set.</td><td></td><td>0
*6</td><td>○</td><td>×</td></tr>
</table>

*6: It is not initialized by RINI or *RST command.

6.3.2 TER? Command

The TER? command reads out the self test result.

1. Command response

   ddddd,ddddd,ddddd,ddddd
   a b c d

2. Meaning of the value a, b, c, and d

   The TER register column in Table 5-18 shows the error causes and resister values of a, b, c, and d. If a VSVM15 V + FS error occurs during the self test, the following command is responded.

   00000,00000,00016,00000

6.4 Programming Example

A basic program example to operate the R6240A from a computer via GPIB connection is introduced below.

Computer: FMV-5350ML3 (FUJITSU), Windows98
GPIB software: PCI-GPIB (NATIONAL INSTRUMENTS)
Module: Niglobal.bas, Vbib-32.bas (the software included with NI-488.2)
Language: Visual Basic 6

Visual Basic program examples to perform same operation as described in Section 2.2, "Basic Operation".

- Program example 1: Example of DC measurement introduced in Section 2.2.5
- Program example 2: Example of Pulse measurement introduced in Section 2.2.6
- Program example 3: Example of Sweep measurement introduced in Section 2.2.7
- Program example 4: Example of reading out measurement data from the measurement buffer memory as fast as possible

6.4.1 Programming Example 1: DC Measurement

```
Option Explicit                          ' Explicit declaration for all variables

Private Sub Start_Click()                ' Event procedure of the command button (Start)
  Dim board As Integer                   ' GPIB board address
  Dim pad As Integer                     ' R6240A address
  Dim vig As Integer                     ' R6240A device descriptor

  board=0                                ' GPIB board address 0
  pad=1                                  ' R6240A address 1

  Call ibdev(board,pad,0,T10s,1,0,vig)   ' Opening the R6240A and initializing it (time out 10 s)
  Call ibconfig(vig,IbcUnAddr,1)         ' Setting the address for every transmitting and receiving

  Call SUBsend(vig,"C,*RST")             ' Initializing DCL and parameter
  Call SUBsend(vig,"M1")                 ' Trigger mode hold
  Call SUBsend(vig,"VF")                 ' Voltage source function
  Call SUBsend(vig,"F2")                 ' Current measurement function

  Call SUBsend(vig,"SOV1,LMI0.003")      ' DC source value 1 V, limiter value 3 mA
  Call SUBsend(vig,"OPR")                ' Setting output to ON
  Call SUBmeas(vig)                      ' Reading measurement trigger and data

  Call SUBsend(vig,"SOV2")               ' DC source value 2 V
  Call SUBmeas(vig)                      ' Reading measurement trigger and data

  Call SUBsend(vig,"SOV-2")              ' DC source value -2 V
  Call SUBmeas(vig)                      ' Measurement trigger & data recall

  Call SUBsend(vig,"SOV4")               ' DC source value 4 V
  Call SUBmeas(vig)                      ' Measurement trigger & data recall

  Call SUBsend(vig,"F1")                 ' Voltage measurement function
```

```
  Call SUBsend(vig,"IF")                  ' Current source function
  Call SUBsend(vig,"SOI0.002,LMV3"        ' DC source value 2 mA, limiter value 3 V
  Call SUBsend(vig,"OPR")                 ' Setting output to ON
  Call SUBmeas(vig)                       ' Measurement trigger & data recall

  Call SUBsend(vig,"SBY")                 ' Setting output to OFF

  Call ibonl(vig,0)                       ' Setting the R6240A to offline
End Sub                                   ' Event procedure completed

                                          ' Subroutine
Private Sub SUBmeas(vig As Integer)       ' Measurement data recall by measurement trigger
  Dim dt As String*17                     ' Data reception buffer

  Call ibwrt(vig,"*TRG" & Chr(10))        ' Measurement trigger actuated
  Call ibrd(vig,dt)                       ' Measurement data recall

  Text1.SelStart=Len(Text1.Text)          ' Specifying display position for text box (Text 1)
  Text1.SelText=dt                        ' Displaying measurement data in text box (Text 1)
End Sub

                                          ' Subroutine
Private Sub SUBsend(vig As Integer,cmd As String)
                                          ' Send command character string

  Call ibwrt(vig,cmd & Chr(10))           ' Sending command character string + terminator LF (Char (10))

End Sub
```

(Output example)

```
  DI +1.00000E-03
  DI +2.00000E-03
  DI -2.00000E-03
  DIU+3.00000E-03
  DV +2.00000E+00
```

6.4.2 Programming Example 2: Pulse Measurement

```
Option Explicit                          ' Exlicit declaration for all the variables

Private Sub Start_Click()                ' Event procedure for the command button (Start)
  Dim board As Integer                   ' GPIB board address
  Dim pad As Integer                     ' R6240A address
  Dim vig As Integer                     ' R6240A device descriptor

  board=0                                ' GPIB board address 0
  pad=1                                  ' R6240A address 1

  Call ibdev(board,pad,0,T10s,1,0,vig)   ' Opening and initializing device (R6240A) (time out 10 s)
  Call ibconfig(vig,IbcUnAddr,1)         ' Address setting performed for each transmission or reception

  Call SUBsend(vig,"C,*RST")             ' DCL and parameter Initialization
  Call SUBsend(vig,"M1")                 ' Trigger mode hold
  Call SUBsend(vig,"VF")                 ' Voltage source function
  Call SUBsend(vig,"F2")                 ' Current measurement function
  Call SUBsend(vig,"MD1")                ' Pulse source mode

  Call SUBsend(vig,"SOV2,LMI0.003")      ' Pulse source value 2 V, limiter value 3 mA
  Call SUBsend(vig,"DBV1")               ' Pulse base value 1 V
  Call SUBsend(vig,"SP3,1,130,50")       ' Hold time 3 ms, measurement delay time 1 ms
                                         ' Period 130 ms, pulse time 50 ms
  Call SUBsend(vig,"OPR")                ' Output ON
  Call SUBmeas(vig)                      ' Measurement trigger & data recall

  Call SUBsend(vig,"SOV2.5")             ' Pulse source value 2.5 V
  Call SUBmeas(vig)                      ' Measurement trigger & data recall

  Call SUBsend(vig,"SP3,60,130,50")      ' Hold time 3 ms, measurement delay time 60 ms
                                         ' Period 130 ms, pulse time 50 ms
  Call SUBmeas(vig)                      ' Measurement trigger & data recall

  Call SUBsend(vig, "DBV0.5")            ' Pulse base value 0.5 V
  Call SUBmeas(vig)                      ' Measurement trigger & data recall

  Call SUBsend(vig,"SBY")                ' Output OFF

  Call ibonl(vig,0)                      ' Setting the R6240A to offline
End Sub                                  ' Event procedure completed


                                         ' Subroutine
Private Sub SUBmeas(vig As Integer)      ' Measurement data recall by measurement trigger
  Dim dt As String*17                    ' Data reception buffer

  Call ibwrt(vig, "*TRG"&Chr$(10))       ' Measurement trigger actuated
  Call ibrd(vig,dt)                      ' Measurement data recall

  Text1.SelStart=Len(Text1.Text)+1       ' Specifying display position for Text Box (Text1)
  Text1.SelText=dt&vbCrLf                ' Displaying measurement data in Text box (Text1)
End Sub                                  ' Event procedure completed
```

```
                                        ' Subroutine
Private Sub SUBmeas(vig As Integer)     ' Measurement data recall by measurement trigger
  Dim dt String*17                      ' Data reception buffer

  Call ibwrt(vig,"*TRG" & Chr(10))      ' Measurement trigger actuated
  Call ibwrt(vig,dt)                    ' Measurement data recall

  Text1.SelStart=Len(Text1.Text)        ' Specifying display position for Text Box (Text1)
  Text1.SelText=dt                      ' Displaying the measurement data in Text box (Text 1)
End Sub


                                        ' Subroutine
Private Sub SUBsend(vig As Integer,cmd As String)
                                        ' Sending command character string

  Call ibwrt(vig,cmd & Chr(10))         ' Sending command character string + terminator LF (Char (10))

End Sub
```

(Output example)

```
  DI +2.00000E-03
  DI +2.50000E-03
  DI +1.00000E-03
  DI +0.50000E-03
```

6.4.3 Programming Example 3: Sweep Measurement

```
Option Explicit                              ' Explicit declaration for all variables

Private Sub Start_Click()                    ' Event procedure for the command button (Start)
  Dim board As Integer                       ' GPIB board address
  Dim pad As Integer                         ' R6240A address
  Dim vig As Integer                         ' R6240A device descriptor
  Dim dt As String*17                        ' Data reception buffer
  Dim s As Integer                           ' Serial poll results storage variable

  board = 0                                  ' GPIB board address 0
  pad = 1                                    ' R6240A address 1

  Call ibdev(board,pad,0,T10s,1,0,vig)       ' Opening and initializing device (R6240A) (time out 10 s)
  Call ibconfig(vig,IbcUnAddr,1)             ' Address setting performed for each transmission or reception


  Call SUBsend(vig,"C,*RST")                 ' DCL and parameter Initialization
  Call SUBsend(vig,"*CLS")                   ' Initializing status byte
  Call SUBsend(vig,"*SRE8")                  ' Setting bit3 for the Service Request Enable Register to 1
  Call SUBsend(vig,"DSE8192")                ' Setting bit 13 for the Device Event Enable register to 1
  Call SUBsend(vig,"S0")                     ' SRQ transmission mode
                                             ' Register setting for transmitting SRQ following completion of Sweep
  Call SUBsend(vig,"VF")                     ' Voltage source function
  Call SUBsend(vig,"F2")                     ' Current measurement function
  Call SUBsend(vig,"MD2")                    ' Sweep source mode

  Call SUBsend(vig,"SN1,10,1")               ' Linear Sweep: Start 1 V, stop 10 V, and step 1 V
  Call SUBsend(vig,"BS0")                    ' Sweep bias value 0 V
  Call SUBsend(vig,"SP3,4,100")              ' Hold time 3 ms, Measurement delay time 4 ms
                                             ' Period 100 ms
  Call SUBsend(vig,"LMI0.03")                ' Limiter value 30 mA

  Call SUBsend(vig,"ST1,RL")                 ' Memory Store ON, clearing memory

  Call SUBsend(vig,"OPR")                    ' Output ON
  Call SUBsend(vig,"*TRG")                   ' Sweep starts

                                             ' Waiting for sweep measurement completion
  Call ibwait(vig,RQS Or TIMO)               ' Waiting for SRQ transmission
  If (ibsta And TIMO) Then                   ' In case of time out
    Call MsgBox("SRQ Time Out",vbOKOnly,"Error")
                                             ' Error indication
  Else                                       ' If no timeout
    Call ibrsp(vig,s)                        ' Executing serial poll
  End If                                     ' Ending If

  Call SUBsend(vig,"SBY")                    ' Output OFF

                                             ' Measurement buffer memory data recall
  Call SUBsend(vig,"RN1,0")                  ' Setting to measurement buffer memory recall mode and
                                             ' Specifying recall address from 0
  Do                                         ' Infinite loop


    Call SUBread(vig,dt)                     ' Measurement buffer memory data recall
```

```
                                        ' Outputting memory data by data recall after memory recall mode
                                        ' setting, adding recall number by 1
    If 1=InStr(1,dt,"EE+8.88888E+30") Then
                                        ' If recalled data is empty,
      Exit Do                           ' exiting infinite loop
    End If                              ' Ending If
  Loop                                  ' Ending Do
  Call SUBsend(vig,"RN0,0")             ' Releasing measurement buffer memory recall mode

  Call ibonl(vig,0)                     ' Setting the R6240A to offline
End Sub                                 ' Event procedure completed

                                        ' Subroutine
Private Sub SUBread(vig As Integer,dt As String)
                                        ' Recalling talker data

  Call ibrd(vig,dt)                     ' Recalling talker data

  Text1.SelStart=Len(Text1.Text)        ' Specifying display position for Text Box (Text1)
  Text1.SelText=dt                      ' Displaying measurement data in text box (Text 1)
End Sub

                                        ' Subroutine
Private Sub SUBsend(vig As Integer,cmd As String)
                                        ' Sending command character string

  Call ibwrt(vig,cmd & Chr(10))         ' Sending command character string + terminator LF (Char (10))

End Sub
```

(Output example)

```
  DI +01.0000E-03
  DI +02.0000E-03
  DI +03.0000E-03
  DI +04.0000E-03
  DI +05.0000E-03
  DI +06.0000E-03
  DI +07.0000E-03
  DI +08.0000E-03
  DI +09.0000E-03
  DI +10.0000E-03
  EE +8.88888E+30
```

6.4.4 Programming Example 4: Using Measurement Buffer Memory

(Example: 100 measurement data is recalled in the shortest time)

```
Option Explicit                              ' Explicit declaration for all variables

Private Sub Start_Click()                    ' Event procedure for the command button (Start)
  Dim board As Integer                       ' GPIB port address
  Dim pad As Integer                         ' R6240A address
  Dim vig As Integer                         ' R6240A device descriptor
  Dim dt As String*17                        ' Data reception buffer
  Dim dt_sz As Integer                       ' Number of measurement buffer memory data
  Dim dt_rn(100) As String*16                ' Measurement buffer memory data storage string variable
  Dim i As Integer,s As Integer              ' i: Loop variable, s: Serial poll result storage variable

  board = 0                                  ' GPIB port address 0
  pad = 1                                    ' R6240A address 1

  Call ibdev(board,pad,0,T30s,1,0,vig)       ' Opening and initializing the R6240A (timeout 30 s)
  Call ibconfig(vig,IbcUnAddr,1)             ' Address setting performed for each transmission or reception

                                             ' Executing Sweep measurement
  Call SUBsend(vig,"C,*RST")                 ' DCL and parameter Initialization
  Call SUBsend(vig,"*CLS")                   ' Status byte initialization
  Call SUBsend(vig,"*SRE8")                  ' Setting bit 3 for the Service Request Enable Register to 1
  Call SUBsend(vig,"DSE8192")                ' Setting bit 13 for the Device Event Enable Register to 1
  Call SUBsend(vig,"S0")                     ' SRQ transmission mode
                                             ' Register setting for transmitting SRQ following completion of Sweep
  Call SUBsend(vig,"VF")                     ' Voltage source function
  Call SUBsend(vig,"F2")                     ' Current source function
  Call SUBsend(vig,"MD2")                    ' Sweep source mode

  Call SUBsend(vig,"SN0.1,10,0.1")           ' Linear Sweep: Start 0.1 V, stop 10 V, and step 0.1 V
  Call SUBsend(vig,"SB0")                    ' Sweep bias value 0 V
  Call SUBsend(vig,"SP3,4,100")              ' Hold time 3 ms, Measurement delay time 4 ms
                                             ' Period: 100 ms
  Call SUBsend(vig,"LMI0.03")                ' Limiter value: 30 mA

  Call SUBsend(vig,"ST1,RL")                 ' Memory store ON, clearing memory

  Call SUBsend(vig,"OPR")                    ' Output ON
  Call SUBsend(vig,"*TRG")                   ' Starting Sweep

                                             ' Waiting for Sweep measurement completing
  Call ibwait(vig,RQS Or TIMO)               ' Waiting for SRQ transmission
  If (ibsta And TIMO) Then                   ' In case of time out
    Call MsgBox("SRQ Time Out",vbOKOnly,"Error")
                                             ' Indicating error
  Else                                       ' If no timeout
    Call ibrsp(vig,s)                        ' Executing serial poll
  End If                                     ' Ending If

  Call SUBsend(vig,"SBY")                    ' Output OFF
```

```
                                        ' Measurement buffer memory data recall
                                        ' No output data header, block delimiter EOI
  Call SUBsend(vig,"SZ?")               ' Measurement buffer memory data number query
  Call SUBread(vig, dt)                 ' Measurement buffer memory data number recall
  dt_sz = Val(dt)
                                        ' Converting recalled data to numerical variable
  Call SUBsend(vig, "OH0")              ' Setting output data number header to OFF
  Call SUBsend(vig, "DL2")              ' Setting -output data block delimiter to EOI
  Call SUBsend(vig, "RN1,0")            ' Setting to measurement buffer memory output mode
                                        ' Specifying output number from 0
  For i=1 To dt_sz                      ' Repeating for number of memory
    Call SUBread(vig, dt)               ' Measurement buffer memory data recall
                                        ' Outputting memory data by recall after memory recall mode setting,
                                        ' adding output number by + 1
    dt_rn(i) = dt
                                        ' Storing recalled data in order
  Next i                                ' Ending For
  Call SUBsend(vig, "RN0,0")            ' Releasing measurement buffer memory output mode

                                        ' Displaying the measurement data
  For i=1 To dt_sz                      ' Memory data repeats itself several times
    dt=Str(i)&":"&dt_rn(i)              ' Form character strings
    Text1.SelStart=Len(Text1.Text)      ' Specifying display position for text Box (Text1)
    Text1.SelText=dt                    ' Displaying measurement data in text box (Text1)
  Next i                                ' Ending For

  Call ibonl(vig, 0)                    ' Setting the R6240A to offline
End Sub                                 ' Event procedure completed

                                        ' Subroutine
Private Sub SUBread(vig As Integer,dt As String)
                                        ' Recalling talker data

  Call ibrd(vig, dt)                    ' Recalling talker data

End Sub

                                        ' Subroutine
Private Sub SUBsend(vig As Integer, cmd As String)
                                        ' Sending command character string

  Call ibwrt(vig, cmd & Chr(10))        ' Sending command character string + terminator LF (Char (10))

End Sub
```

(Output example)

```
  1:+00.1000E-03
  2:+00.2000E-03
  3:+00.3000E-03
  | (Omitted)
  98:+09.8000E-03
  99:+09.9000E-03
  100:+10.0000E-03
```