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Chapter 1
Operation of the Simulator as a Serial or GPIB Device

This chapter describes the different settings and information for using the simulator as either a GPIB or serial device.

NI Instrument Simulator Overview

The NI Instrument Simulator allows the simulation of either a GPIB device (G mode) or a serial device (S mode). In either mode, the simulator emulates typical output from a digitizing oscilloscope or a digital multimeter. In S mode, GPIB-specific functionality (SRQ and GPIB addressing) are not supported.

The Instrument Simulator is ideal for debugging or training. Using the simulator, instead of traditional instruments, to debug systems saves time and effort. Also, National Instruments uses the simulator in our customer education courses.

Rear Panel

The labeled configuration switches, located on the rear panel, control the simulator emulation mode (G mode or S mode) as well as settings specific to each mode. The unmarked DIP switches are reserved for future development and should remain in the OFF position. Figure 1-1 shows the rear panel.
GPIB Device Emulation

You can configure the simulator to mimic a GPIB device using the switch settings on the rear panel of the unit. This emulation is similar to an IEEE 488.2 device, but not to the exact specifications. To make the simulator act as a GPIB device, set the S MODE/G MODE switch to G MODE (switch 8 is ON as shown in Figure 1-2). Switches 6 and 7 must remain in the OFF position while the simulator is in G mode.

The primary GPIB address is determined using the switches labeled “GPIB Address”. The secondary address can be set using the SADDR command. If you want to change the primary address, power off the unit and change the switch settings. Figure 1-2 shows the simulator configured to emulate a GPIB device at primary GPIB address 2.

Note: The numbers 1-8 do not actually appear on the box. They are included in the picture as a reference aid.

Figure 1-2. Sample GPIB Emulation Mode Switch Setting
The settings for each of the GPIB primary addresses are shown in Table 1-1. The factory default setting, GPIB address 2, is shown in bold italic.

Table 1-1. GPIB Address Switch Settings for GPIB Device Emulation

<table>
<thead>
<tr>
<th>Switches</th>
<th>GPIB Address</th>
</tr>
</thead>
<tbody>
<tr>
<td>OFF</td>
<td>OFF</td>
</tr>
<tr>
<td>ON</td>
<td>OFF</td>
</tr>
<tr>
<td>OFF</td>
<td>ON</td>
</tr>
<tr>
<td>ON</td>
<td>ON</td>
</tr>
<tr>
<td>OFF</td>
<td>OFF</td>
</tr>
<tr>
<td>ON</td>
<td>OFF</td>
</tr>
<tr>
<td>OFF</td>
<td>ON</td>
</tr>
<tr>
<td>ON</td>
<td>ON</td>
</tr>
<tr>
<td>OFF</td>
<td>OFF</td>
</tr>
<tr>
<td>ON</td>
<td>OFF</td>
</tr>
<tr>
<td>OFF</td>
<td>ON</td>
</tr>
<tr>
<td>ON</td>
<td>ON</td>
</tr>
<tr>
<td>OFF</td>
<td>OFF</td>
</tr>
<tr>
<td>ON</td>
<td>OFF</td>
</tr>
<tr>
<td>OFF</td>
<td>ON</td>
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<tr>
<td>ON</td>
<td>ON</td>
</tr>
<tr>
<td>OFF</td>
<td>OFF</td>
</tr>
<tr>
<td>ON</td>
<td>OFF</td>
</tr>
<tr>
<td>OFF</td>
<td>ON</td>
</tr>
<tr>
<td>ON</td>
<td>ON</td>
</tr>
<tr>
<td>OFF</td>
<td>OFF</td>
</tr>
<tr>
<td>ON</td>
<td>OFF</td>
</tr>
<tr>
<td>OFF</td>
<td>ON</td>
</tr>
<tr>
<td>ON</td>
<td>ON</td>
</tr>
<tr>
<td>OFF</td>
<td>OFF</td>
</tr>
</tbody>
</table>
GPIB-Emulation Specific Information

When the simulator is emulating a GPIB device, you must use a specific command order in some cases. When you write a command that returns data, you must perform a read of at least 1 byte before trying to send a second command to the simulator. If you attempt to send a command before reading some data, it is not accepted and the command times out.

If you perform a partial read of the simulator response to a command request and then issue another command, the remaining data of the partial read no longer exists.

Serial Device Emulation

You can configure the simulator to mimic a serial device using the settings on the rear panel of the unit. If you want to change the configuration of the simulator, power off the unit and change the switch settings.

To make the simulator emulate a serial device, set the S mode/G mode switch to S mode (switch 8 is OFF as shown in Figure 1-3). Switches 1 through 3 set the baud rate, and switches 4 through 7 set the data format. Figure 1-3 shows the DIP switch.

Note: The numbers 1-8 do not actually appear on the box. They are included in the picture as a reference aid.
In Figure 1-3, switch 8 is set to S mode, so the labels on top of the switch apply. Switches 1 through 3 are ON, OFF, and ON, respectively, indicating that the serial port is operating at 9600 baud. Switches 4 and 5 are both OFF, which indicates that parity is disabled. Switch 6 is OFF, indicating 1 stop bit/character. Switch 7 is ON, indicating that the simulator is using 8 bits per character for serial data transfers. The unmarked DIP switches on the rear panel are reserved for future development and should remain in the OFF position.

Tables 1-2 and 1-3 show the possible configurations for the baud rate and data format switches when you are using serial emulation and what each configuration indicates.

**Table 1-2.** S Mode Switch Settings for Serial Port Baud Rate

<table>
<thead>
<tr>
<th>Switches</th>
<th>Baud Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 OFF</td>
<td>OFF</td>
</tr>
<tr>
<td>2 OFF</td>
<td>OFF</td>
</tr>
<tr>
<td>3 OFF</td>
<td>OFF</td>
</tr>
<tr>
<td>4 OFF</td>
<td>OFF</td>
</tr>
<tr>
<td>5 OFF</td>
<td>OFF</td>
</tr>
<tr>
<td>6 OFF</td>
<td>OFF</td>
</tr>
<tr>
<td>7 OFF</td>
<td>OFF</td>
</tr>
<tr>
<td>8 OFF</td>
<td>OFF</td>
</tr>
<tr>
<td>9 ON</td>
<td>ON</td>
</tr>
<tr>
<td>10 ON</td>
<td>ON</td>
</tr>
<tr>
<td>11 ON</td>
<td>ON</td>
</tr>
<tr>
<td>12 ON</td>
<td>ON</td>
</tr>
<tr>
<td>13 ON</td>
<td>ON</td>
</tr>
<tr>
<td>14 ON</td>
<td>ON</td>
</tr>
<tr>
<td>15 ON</td>
<td>ON</td>
</tr>
<tr>
<td>16 ON</td>
<td>ON</td>
</tr>
</tbody>
</table>

© National Instruments Corporation 1-5 NI Instrument Simulator User Manual
To operate the Instrument Simulator as a serial device, set switch 8 to OFF (S mode). Set the remaining switches to match the characteristics of the terminal or computer you attach to the other end of the serial cable. Often, you can change the serial port characteristics of the terminal or computer by setting switches or running a utility program, or from within a programming environment.

To use the simulator as a serial device, your software and serial cable must support RTS/CTS (Hardware) flow control.

When the simulator is acting as a serial device, the LEDs provide information about the state of the unit. Table 1-4 describes each state.
Serial-Emulation Specific Information

When using the simulator as a serial device, you should be aware of special issues dealing with command termination, RTS/CTS flow control, message headers, end-of-string character choice, and ATN and SRQ LEDs.

Command Termination

When using the unit as a serial device simulator, terminate commands with either a carriage return or line feed so the unit knows when the command is complete, otherwise it does not act on the command.

RTS/CTS (Hardware Flow Control)

The unit uses RTS/CTS flow control to indicate when it is ready to receive data and when the controller is ready to receive data. This prevents data corruption and errors that may occur when the unit is not ready to receive data. You must use a serial cable and software that supports RTS/CTS flow control.

Serial Message Header

When the simulator is emulating a serial device, it sends a header before every response indicating how many data bytes are to follow. This header takes the form of "xxxxxx\r\n" and should be read to indicate how many bytes are to follow.

<table>
<thead>
<tr>
<th>LED</th>
<th>State of the Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>LISTEN</td>
<td>Unit is waiting for a command.</td>
</tr>
<tr>
<td>TALK</td>
<td>Unit is sending data using serial interface.</td>
</tr>
<tr>
<td>LISTEN and TALK</td>
<td>Receive error-current command will be ignored. Resend</td>
</tr>
<tr>
<td>are ON</td>
<td>command to clear error.</td>
</tr>
<tr>
<td>LISTEN and TALK</td>
<td>When the unit has the ready and power LEDs ON, but the</td>
</tr>
<tr>
<td>are both OFF</td>
<td>listen and talk LEDs are off, the unit is preparing a</td>
</tr>
<tr>
<td></td>
<td>response (for example, preparing a sine wave for</td>
</tr>
<tr>
<td></td>
<td>output.)</td>
</tr>
</tbody>
</table>

Table 1-4. LED Information in S Mode
many bytes will follow. An example is a response to the "*tst?" command.

Command:  *tst?

Response:  00003\r\nOK\n
The 00003 indicates that there are three more bytes after the header. The header eliminates timeouts due to reading the serial port before data is present and specifies how much data is actually present. This information is important because serial transfers do not specify an end-of-string character.

**End-of-String Character**

For serial input from the simulator, the EOS character should be set to NONE because simulator responses can contain the NULL byte (00) and \r\n, which could cause a premature termination of the serial port read.

**ATN and SRQ LEDs**

The ATN and SRQ LEDs indicate service request and attention assertion and are useful only for GPIB emulation. The ATN LED may be lit, but you should ignore it if the simulator is in serial emulation mode. The SRQ LED indicates that the device is requesting service, but use it as a visual clue only. You should read the STB register to determine the status byte.

**Common Problems With Serial Emulation**

Other serial mode considerations are as follows:

- If you are sending commands but the serial simulator is not responding, be sure that the commands are terminated with a carriage return or line feed.
- If you notice that you are not receiving the complete message, for example "sys:help?" only sends back "SYS:HELP?", check the EOS character being used. It should be set to NONE. If it is set to LF or CR, the read is terminated prematurely.
Chapter 2
NI Instrument Simulator
Command Set

This chapter describes the command set used by the Instrument Simulator, including examples to illustrate usage.

Waveform Format

The Instrument Simulator generates a 128-point waveform in either ASCII or binary. ASCII waveforms are preceded by the header CURVE. Binary waveforms are preceded by a pound sign (#) and the number of bytes that are in the waveform. All waveforms terminate with a line feed <LF> character.

Floating Point ASCII (default)
CURVE<space>num0,num1,...,num127<LF>

The floating point format used is [+][-]1.2345[E[+][-]0]

8-bit Unsigned Binary
#3128<Byte 0><Byte 1>...<Byte127><LF>

16-bit Signed Binary (NORMal byte order)
#3256<MSB 0><LSB 0>...<MSB 127><LSB 127><LF>

16-bit Signed Binary (SWAPped byte order)
#3256<LSB 0><MSB 0>...<LSB 127><MSB 127><LF>

Simulator Commands

The Instrument Simulator uses SCPI-like commands. The commands are shown in long form; however, the simulator accepts only the short form of the command. Send only the part of the command that is shown in BOLD UPPERCASE characters. You can send multiple commands to the simulator by separating them with a semicolon (;).
Address Command

You can use the address command to change the GPIB address used by the simulator. The power-on default for the primary GPIB address is determined by the rear panel switch setting. Secondary addressing is disabled by default. The address command is used as follows:

```
SADDR primary, secondary
```

Examples

<table>
<thead>
<tr>
<th>Command</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>SADDR 2</td>
<td>Set the address to 2</td>
</tr>
<tr>
<td>SADDR 3, 4</td>
<td>Set the primary address to 3 and the secondary address to 4</td>
</tr>
</tbody>
</table>

Waveform Format Commands

The following commands format how the waveform data is returned by the simulator.

```
FORMat:DATA
ASCii          Floating point (default)
INTeger,8      8-bit unsigned binary
INTeger,16     16-bit signed binary

FORMat:DATA?   Returns the current waveform format
```

The following command changes the order of the bytes returned by INTeger,16 encoding.

```
FORMat:BORDer
NORMal         High byte first <MSB><LSB>
SWAPped        Low byte first<LSB><MSB> (default)

FORMat:BORDer? Returns the current format of the byte order
```

Examples

<table>
<thead>
<tr>
<th>Command</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>FORM:DATA INT,16</td>
<td>Set the waveform format as 16-bit integers</td>
</tr>
</tbody>
</table>
Waveform Generation Commands

These commands generate a 128-point waveform of the specified type. The number of cycles in the waveform is random. Waveform generation can take 2 to 15 seconds, depending on the format and type of the waveform. Typically, ASCII waveforms take longer than binary waveforms.

```plaintext
SOURce:FUNCtion
  SINEusoid        Sine waveform (default)
  SQUare          Square waveform
  NOISE           Noisy sine waveform
  RANDOM          Random noise waveform
  PChirp          Chirp waveform

SOURce:FUNCtion?
  Returns the current waveform type
```

Examples

```plaintext
SOUR:FUNC SIN   Generate a sinusoid waveform
SOUR:FUNC?
  Query the current waveform type. For example, if the command was issued after the preceding command, it would return SOUR:FUNC SIN<LF>
```

Waveform Query Commands

```plaintext
SENSe:DATA?
  Returns the waveform data in the format specified by the waveform format commands

SENSe:VOLTage:RANGE:OFFSet?
  Returns the Y offset for the waveform in ASCII floating point

SENSe:VOLTage:RANGE?
  Returns the Y multiplier for the waveform in ASCII floating point
```
**NI Instrument Simulator Command Set**

**SENSe:SWEep:TIME?**  
Returns the X increment (1E-3) in ASCII floating point

**SENSe:VOLTage:HEADER?**  
Returns all of the waveform scaling information in the format  
OFFSET=x.xxxxE+x,  
RANGE=x.xxxxE+x,  
TIME=1E-3<LF>

For integer-formatted waveforms, the offset and range are used to scale the raw integer data as follows:

ScaledPoint[i] = (WaveformPoint[i] + offset) * range

**Examples**

SENSe:DATA?  
Query simulator for the waveform

SENSe:VOLT:HEADER?  
Query simulator for the waveform scaling information

**Multimeter Configuration Commands**

These commands simulate the operation of a meter. They return one value in ASCII floating point.

**MEASure:DC?**  
Returns a random value between 0 to +x in floating point ASCII. The range of x depends on the CONFIGure:DC command

**CONFIGure:DC**

DEFault  
MEASure:DC? returns a number between 0 and 10

MIN  
MEASure:DC? returns a number between 0 and 1

MAX  
MEASure:DC? returns a number between 0 and 100

**CONFigure:DC?**  
Returns the current configuration setting

**Examples**

CONF:DC MAX  
Set the maximum range
**CONF:DC?**
Query the current DC range. For example, if the command was issued after the command above, it would return `CONF:DC MAX<LF>`

**MEAS:DC?**
Queries one value, for example `1.2308<LF>`

**Other Commands**
These commands perform miscellaneous functionality as indicated in the description of each command.

**IDN?**
Returns *National Instruments GPIB and Serial Device Simulator Rev B.x* <LF>

**RST**
Resets the simulator to its default state

**TRG**
Triggers the simulator and returns one random reading (same as **MEAS:DC?**)

**TST?**
Simulates testing the simulator, returns *OK*

**OPC**
Sets the operation complete bit in the Standard Event Status Register (ESR)

**OPC?**
Returns a 1 regardless of the OPC bit value.

**FORMat:SREGister**

**ASCII**
Specifies the output of ESR, ESE, STB, and SRE registers as an ASCII string (default)

**HEX**
Specifies the output of ESR, ESE, STB, and SRE registers in hex

**ESR?**
Returns value of Standard Event Status register as specified by **FORM:SREG**

Figure 2-1 illustrates the bits defined by the simulator for the ESR register: bit 7 (Power On), bit 5 (Command Error), and bit 0 (Operation Complete). Bit 7 is set when the simulator is powered on; bit 5 is set when the simulator receives an invalid command; bit 0 is set when the simulator receives the **OPC** command. You can use the **ESR?**
command to query the value of the ESR register. The value returned is in either ASCII or HEX, as specified by the FORMat:SREGister command. The ESR register is cleared after you read it.

![Figure 2-1. Three ESR Bits Set by the Simulator](image)

*ESE 0x##

Sets value of Standard Event Status Enable register, ## represents a mask in hex

*ESE?

Returns value of Standard Event Status Enable register as specified by FORM:SREG

*STB?

Returns value of Status Byte register as specified by FORM:SREG

Figure 2-2 illustrates the bits defined by the simulator for the STB register: bit 6 (Request Service), bit 5 (ESB condition is met) and bit 4 (Message Available “MAV” is true). When any of these conditions are set in the SRE byte, and it becomes set in the STB, an SRQ is generated. The SRQ bit is cleared after the request is serviced. You can use the Serial Poll Service (G mode only), or request the STB using the *STB? command to query the status information. The value returned is either ASCII or HEX, depending on the format specified by the FORMat:SREGister command.
Figure 2-2. STB Byte and Description

*SRE 0x##
Sets value of Service Request Enable register. ## represents a mask in hex.

*SRE?
Returns value of Service Request Enable register as specified by FORM:SREG

*WAI
No functionality; included to make the simulator IEEE 488.2 compatible

FORMAT:SREGister?
Returns the current format of the registers

SYStem:HELP?
Returns a list of all of the commands
This chapter gives several sample Instrument Simulator applications. The examples use LabVIEW, LabWindows/CVI, and IBIC (the GPIB interactive control utility).

**LabVIEW Examples**

**Example 1**

This example shows the front panel and diagrams for a VI that acquires and displays a square wave from a LabVIEW simulator in G mode or S mode.

![Figure 3-1. Example 1 Front Panel](image)
Figure 3-2. Example 1 Sequence Frame 0 Diagram
Figure 3-3. Example 1 Sequence Frame 1 Diagram
Example 2

This example shows the LabVIEW front panel and diagrams for a VI that configures the simulator in G mode to assert an SRQ after generating a chirp wave. The generated chirp wave is retrieved and displayed.

Figure 3-4. Example 2 Front Panel

Figure 3-5. Example 2 Sequence Frame 0 Diagram
Examples

Figure 3-6. Example 2 Sequence Frame 1 Diagram

Figure 3-7. Example 2 Sequence Frame 2 Diagram
Examples

Figure 3-8. Example 2 Sequence Frame 3 Diagram

Figure 3-9. Example 2 Sequence Frame 4 Diagram
Example 3

This example shows the LabVIEW front panel and diagrams for a VI that acquires and displays a noisy sine wave from a simulator in G mode.
Examples

Figure 3-12. Example 3 Sequence Frame 0 Diagram

Configure the simulator to send back a noisy sine wave in 8 bit binary.

Figure 3-13. Example 3 Sequence Frame 1 Diagram

Read the waveform string, remove the header and trailing line feed, and cast the string as an array.
Examples

Figure 3-14. Example 3 Sequence Frame 2 Diagram

Figure 3-15. Example 3 Sequence Frame 3 Diagram
LabWindows/CVI Examples

Example 1
/*This example shows how to use a GPIB device to request a square wave and then read
the data and plot the response*/

#include <formatio.h>
#include <userint.h>
#include <gpib.h>

char buffer[2000];
double waveform[2000];
int ud0, ud1;

int main (int argc, char *argv[])
{
    /*initializes the gpib board*/
    ud0 = ibfind ("gpib0");

    /*sets the board as controller in charge*/
    ibsic (ud0);

    /*opens and initializes the device*/
    ud1 = ibfind ("DEV2");

    /*writes the command string*/
    ibwrt (ud1, "SOUR;FUNC SQU;SENS:DATA?", 24);

    /*reads the response data from the device*/
    ibrd (ud1, buffer, 2000);

    /*discards the header and converts ASCII data to floating point array*/
    Scan (buffer, "%s[16]>5250f[x]", waveform);

    /*plots the data*/
    YGraphPopup (*"Waveform Plot", waveform, 130, VAL_DOUBLE);

    return 0;
}
Example 2

/*This example shows how to use the device as a serial device and request a square wave and then plot it*/

#include <rs232.h>
#include <formatio.h>
#include <userint.h>
#include <gpib.h>

int main (int argc, char *argv[])
{
    char buffer[2000];
    char header[8];
    double waveform[2000];
    int ComPort = 1;
    int ByteCount;

    /*opens the COM port and configures it for the serial settings*/
    OpenComConfig (ComPort, "com1", 9600, 0, 8, 1, 512, 512);

    /*writes the command string to the port, note the linefeed at the end*/
    ComWrt (ComPort, "SOUR:FUNC SQU;SENS:DATA?\n", 25);

    /*reads the header to determine how many bytes will follow*/
    ComRd (ComPort, header, 7);

    /*converts the ASCII header into an integer byte count*/
    Scan (header, "%s>%i", &ByteCount);

    /*reads the actual data from the device*/
    ComRd (ComPort, buffer, ByteCount);

    /*closes the COM port so other applications can use it*/
    CloseCom (ComPort);

    /*discards the header and converts ASCII data to floating point array*/
    Scan (buffer, "%s[i6]>%250f[x]", waveform);

    /*plots the data*/
    YGraphPopup ("Waveform Plot", waveform, 128, VAL_DOUBLE);

    return 0;
}
Example 3

/*This example shows how to setup the simulator to assert an SRQ after it generates a chirp wave and is ready to output the data*/

#include <gbib.h>
#include <formatio.h>
#include <userint.h>

int main (int argc, char *argv[])
{
    char buffer[2000]
    double waveform[2000];

    int ud0, ud1;

    static char SPR;

    /*initializes the gpib board*/
    ud0 = ibfind ("gpib0");

    /*sets the board as controller in charge*/
    ibsic (ud0);

    /*opens and initializes the device*/
    ud1 = ibfind ("DEV2");

    /*changes the software configuration parameters*/
    ibconfig (ud0, IbcAUTOPOLL, 0);

    /*writes data to the device*/
    ibwrt (ud1, "*SRE 0x10;SOUR:FUNC PCH;SENS:DATA?", 34);

    /*waits for the SRQ line to be asserted indicating message available*/
    ibwait (ud0, SRQI);

    /*conducts a serial poll*/
    ibrsp (ud1, &SPR);

    /*reads the response data from the device*/
    ibrd (ud1, buffer, 2000);

    /*discards the header and converts to floating point*/
    Scan (buffer, "%s[16]>%128f[x]", waveform);

    /*plots the returned waveform*/
    YGraphPopup ("Waveform Plot", waveform, 128, VAL_DOUBLE);

    return 0;
}
IBIC Example

The following example uses the National Instruments text-based interactive control program (IBIC for GPIB) to communicate with a simulator in G mode. Several of the miscellaneous commands are demonstrated. **Bold** text indicates that the text is automatically printed to the screen.

When you launch IBIC, text similar to the following appears on the screen.

```
National Instruments
wIN32 Interactive Control Program
Copyright (C) 1996 National Instruments, Corp.
All rights reserved.
Type 'help' for help or 'q' to quit.
```

Use `ibdev` to open a device descriptor connected to GPIB0, referencing the device with primary address (PAD) 2 and no secondary address (SAD). The device descriptor uses a 10 s I/O timeout, asserts EOI on the last byte of writes, and uses no EOS modes.

```
: ibdev 0 2 0 13 1 0
```

Use `ibwrt` to request simulator identification as follows.

```
ud0: ibwrt "*idn?"
[0100] ( cmpl )
count:  5
```

Use `ibrd` to read the simulator identification, which is returned as follows.

```
ud0: ibrd 1000
[2100] ( end cmpl )
count:  62
4e 61 74 69 6f 6e 61 6c National
20 49 6e 73 74 72 75 6d Instrum
65 6e 74 73 20 47 50 49 ents GPI
42 20 61 6e 64 20 53 65 Band Se
72 69 61 6c 20 44 65 76 rial Dev
69 63 65 20 53 69 6d 75 ice Simu
6c 61 74 6f 72 20 52 65 lator Re
76 20 42 2e 31 0a v B . 1 .
```
Examples

Use `ibwrt` to request a simulator test as follows.

```
ud0: ibwrt "*tst?"
[0100]   ( cmpl )
count:  5
```

Read the simulator test response.

```
ud0: ibrd 1000
[2100]   ( end cmpl )
count:  3
6f 6b 0a                              o k.
```

Query the current DC range, then read the DC range, as follows.

```
ud0: ibwrt "conf:dc?"
[0100]   ( cmpl )
count:  8
ud0: ibrd 1000
[2100]   ( end cmpl )
count:  13
43 4f 4e 46 3a 20 44 43              CON F :   D C
20 44 45 46 0a                        D E F.
```

Set the maximum response range, then query and read the current DC range again, as follows.

```
ud0: ibwrt "conf:dc max"
[0100]   ( cmpl )
count:  11
ud0: ibwrt "conf:dc?"
[0100]   ( cmpl )
count:  8
ud0: ibrd 1000
[2100]   ( end cmpl )
count:  13
43 4f 4e 46 3a 20 44 43              CON F :   D C
20 4d 41 58 0a                        M A X.
```

Request a DC measurement.

```
ud0: ibwrt "meas:dc?"
[0100]   ( cmpl )
count:  8
```
Request the DC measurement.

```plaintext
ud0: ibrd 1000
[2100]  ( end cmpl )
count:  9
30  2e  37  39  32  35  45  32          0 . 7 9 2 5 E 2
0a                                      .
```

Set the GPIB address of the simulator to PAD 7, SAD 99.

```plaintext
ud0: ibwrt "saddr 7,99"
[0100]  ( cmpl )
count:  10
```

Change the IBIC descriptor to reference device at PAD 7 and SAD 99.

```plaintext
ud0: ibpad 7
[0100]  ( cmpl )
previous value: 2
ud0: ibsad 99
[0100]  ( cmpl )
previous value: 0
```

Trigger and then read a DC measurement.

```plaintext
ud0: ibwrt "*trg?"
[0100]  ( cmpl )
count:  5
ud0: ibrd 1000
[2100]  ( end cmpl )
count:  9
36  2e  30  35  30  39  45  31          6 . 0 5 0 9 E 1
0a                                      .
```

Reset the simulator to the default settings.

```plaintext
ud0: ibwrt "*rst"
[0100]  ( cmpl )
count:  4
```

Reset the IBIC descriptor to the default settings.

```plaintext
ud0: ibonl 1
[0100]  ( cmpl )
```
Examples

Query for waveform scaling information, then read the result.

```plaintext
ud0: ibwrt "sens:volt:head?"
    [0100]    ( cmpl )
    count:  15
ud0: ibrd 1000
    [2100]    ( end cmpl )
    count:  33
4f  46  46  53  45  54  3d  30       OFFSET = 0
2e  30  2c  52  41  4e  47  45       . 0 , RANGE
3d  31  2e  30  2c  54  49  4d       = 1 . 0 , TIM
45  3d  31  2e  30  45  2d  33       E = 1 . 0 E - 3
0a .
```

Place the IBIC descriptor offline.

```plaintext
ud0: ibonl 0
    [0100]    ( cmpl )
```
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