Keysight U1281A/U1282A Handheld Digital Multimeter

Programming Guide

KEYSIGHT TECHNOLOGIES

Notices

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Warranty

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Keysight U1281A/U1282A
Handheld Digital Multimeter

Programming Guide

1 Introduction

This chapter describes the parameters that configure the U1281A/U1282A, and helps you determine the settings to achieve optimum performance.

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Configuring the IR interface

The U1281A/U1282A may be operated via an IR interface. The remote control operation will enable you to manually operate the multimeter via a terminal, or to automatically execute a host computer program.

The default parameters for the U1281A/U1282A are:

- Baud rate : **9600** bits per second
- Parity bit : **None**
- Data bits : **8** data bits
- Number of Stop Bits : **1** bit

Ensure that the serial port terminator to CR/LF is configured for both the transmit and receive settings.

NOTE

- The Carriage Return (CR) character (0x0D, \r) moves the cursor to the beginning of the line without advancing to the next line. This character is used as a new line character in Commodore and Early Macintosh operating systems (OS-9 and earlier).
- The Line Feed (LF) character (0x0A, \n) moves the cursor down to the next line without returning to the beginning of the line. This character is used as a new line character in UNIX-based systems (Linux, Mac OS X, etc.).
- The End Of Line (EOL) sequence (0x0D0x0A, \r\n) is actually two ASCII characters—a combination of the CR and LF characters. It moves the cursor both down to the next line and the beginning of that line. This character is used as a new line character in most other non-Unix operating systems including Microsoft Windows, Symbian OS, and others.

Each time after a ***RST** command is sent to the U1281A/U1282A, the communication buffer (transmit and receive) must be cleared before the next command is sent.

In order to ensure smooth communication, allow sufficient time for the U1281A/U1282A to respond to each command. In most cases, this means refers to a 5-second delay after the ***RST** command and a 200-millisecond delay for all other commands.

For situations where the above delay is insufficient and is related to the serial port hardware, operating system (OS) serial communication buffer, or the central processing unit (CPU) response time, you may consider increasing the delay time to maintain stable communication with the U1281A/U1282A.

Introduction to Remote Commands

Remote commands control instrument functions. A subsystem command has a hierarchical structure that usually consists of a top-level (or root) keyword, one or more lower level keywords, and parameters. The following example shows a query and its associated subsystem:

```
-> CALC:AVER:MAX?
```

CALC is a root level keyword with **AVER** as the second level keyword, and **MAX** as the third-level keyword.

Syntax conventions

Throughout this programming guide, the following conventions are used for remote command syntax:

- Square brackets "[ ]" indicate optional keywords or parameters and can be omitted. The brackets are not sent with the command string. If you do not specify a value for an optional parameter, the instrument chooses a default value.
- Braces "{ }" enclose one or more parameters that may be included zero or more times. The brackets are not sent with the command string.
- Triangle brackets "< >" indicate that you must substitute a value for the enclosed parameter. The brackets are not sent with the command string.
- Parentheses "( )" enclose parameters that are usually a channel list.
- Vertical bars "|" can be read as "or" and are used to separate alternative parameter options.

Only short form commands are recognized by the instrument. For example, consider the keyword **TRIGger**. Only the short form—which is **TRIG**—will be recognized by the instrument. Other forms, such as **TRIGG**, **TRIGge**, or even **TRIGger**, will generate errors. An example of the command syntax format is illustrated below:

```
-> TRIG:SOUR <BUS|REF|IMM>
```

Querying parameter settings

You can query the current value of most parameters by adding a question mark (?) to the command. For example, you can query the function of the primary display measurement by sending:

```
-> CONF?
```

Responding Message

Returned result

After the U1281A/U1282A executes a query command, the return of the result will be in the following format:

```
<- <Result> + <CR> <LF>
```

On the multimeter warning the returned prompts will be in the following format except Xon and Xoff:

```
<- <Prompts> + <CR> <LF>
```

Prompts

The U1281A/U1282A will generate a system warning by sending a prompt string to the host through the remote interface when the U1281A/U1282A has a status change as listed in the table below.

Prompt	Description
* L	Local mode
* C	Calibration mode
* E	Remote command error warning
* B	Low battery warning
* I	Input warning (Please refer to STAT? command)
* 0	Rotary position: ACV measurement
* 1	Rotary position: ACmV measurement
* 2	Rotary position: ACDCV measurement
* 3	Rotary position: ACDCmV measurement
* 4	Rotary position: RES/CONT measurement

Prompt	Description
* 5	Rotary position: Diode/Hz measurement
* 6	Rotary position: CAP/TEMP measurement
* 7	Rotary position: uA/mA measurement
* 8	Rotary position: A measurement
* 9	Rotary position: SQU output
ASC(&H11)	Xon: The meter is available
ASC(&H13)	Xoff: The meter is busy

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2 Remote Commands

This chapter describes the U1281A/U1282A remote commands.

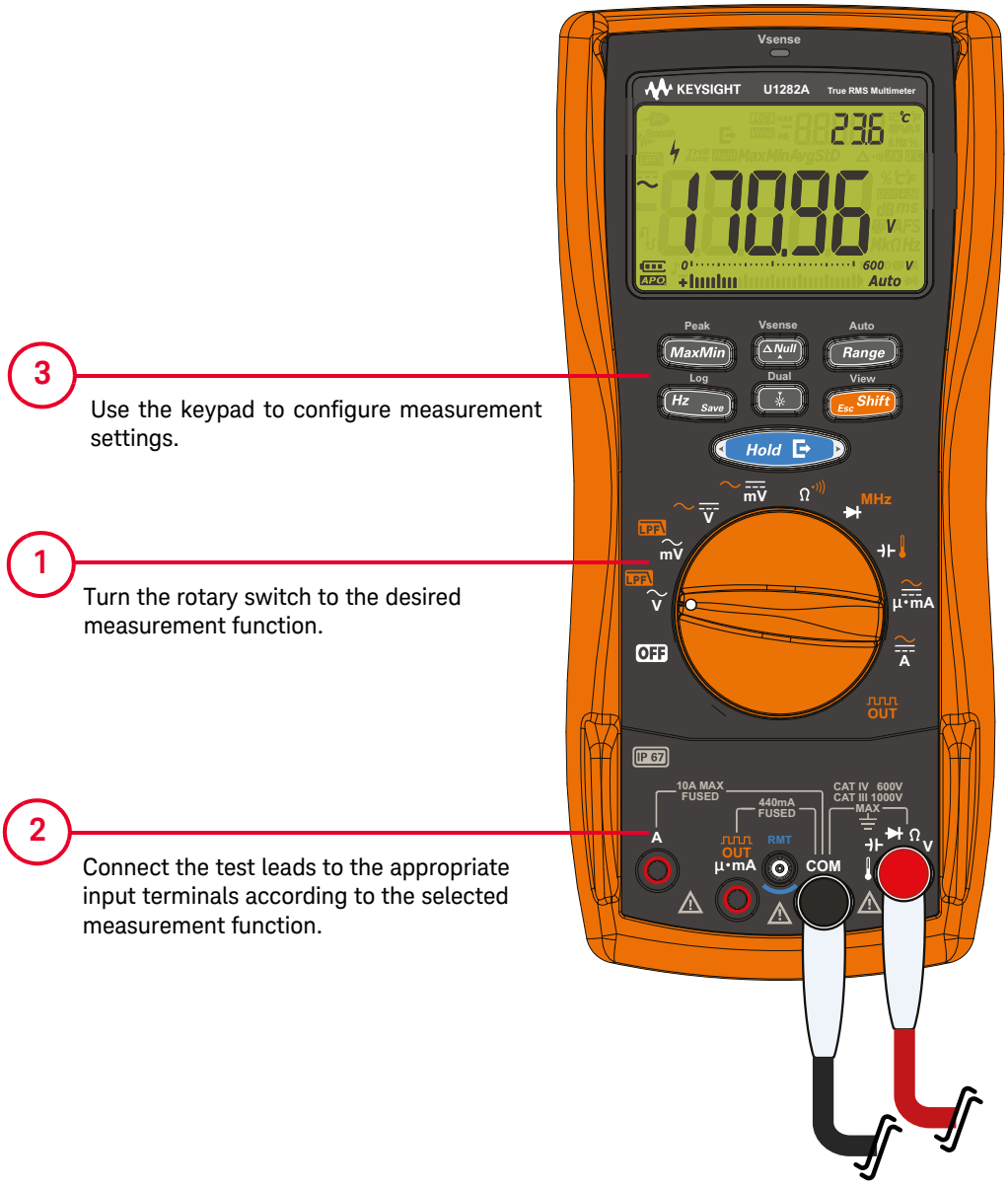
NOTE Ensure that you have configured the U1281A/U1282A before using any of the remote commands. Refer to "**U1281A/U1282A Configuration Overview**" on page 12. For more details, refer to the *U1281A/U1282A User's Guide*.

NOTE Due to the unique Export Log feature of the U1281A/U1282A, you will need to handle the exporting of data when using any of the following functions:

- Trigger Hold
- Auto Hold
- Manual Log
- Interval Log
- Event Log
- Export Log

When you send a command related to any of the above functions, the U1281A/U1282A will return additional information on export log data. If this is not handled properly, it will cause wrong data to be fetched and an exception error to occur. Therefore to always ensure correct data is fetched, it is recommended not to use the above functions during programming.

U1281A/U1282A Configuration Overview



When the above configuration has been made, you can proceed to use the remote commands in the following sections.

*IDN?

Syntax

```
*IDN?
```

Description

The **`*IDN?`** query allows the U1281A/U1282A to identify itself by returning the model number, serial number, and the firmware version. The string returned is, for example:

`Keysight Technologies,<model number>,<serial number>,VXX.xx`

where:

- `<model number>` identifies which U1281A/U1282A model is being used.
- `<serial number>` uniquely identifies each U1281A/U1282A.
- `VXX.xx` represents the firmware revision with XX and xx representing the major and minor revisions respectively.

Example

```
-> *IDN?
```

Returns the model number, serial number, and the firmware version of the multimeter.

```
<- Keysight Technologies,U1282A,DPQ1007000,V1.00
```

*RST

Syntax

```
*RST
```

Description

The *RST (reset) command places the U1281A/U1282A in the power-on-reset state without shutting down the line power and returns the current rotary knob position (refer to "**Prompts**" on page 8 for a legend on rotary knob positions). The interface parameters will return to their default values (refer to "**Configuring the IR interface**" on page 6).

Example

```
-> *RST

<- *1
```

Places the instrument in the power-on-reset state and returns the instrument to the ACmV rotary switch position.

*CLS

Syntax

```
*CLS
```

Description

The *CLS (clear status) command clears the event registers in all register groups. This command also clears the Error queue.

Example

```
-> *CLS
```

The following command clears the event register bits.

ABOR

Syntax

ABOR

Description

This command places the trigger hold system in the idle state.

The display will show a dash (–) until the **INIT** command is triggered.

Example

-> ABOR	Places the trigger hold mode in the idle state

Remarks

This command is only available in trigger hold mode.

CALC:AVER

Query

```
CALC:AVER:MAX|MIN|AVER|PRES|COUN?
```

Description

This query returns the value of the specific dynamic recording function.

- MAX returns the maximum recorded value
- MIN returns the minimum recorded value
- AVER returns the average recorded value
- PRES returns the present recorded value
- COUN returns the count value of the average mode

Example

```
-> CALC:AVER:MAX?
<- +2.63782000E+00
```

Returns the maximum recorded value

CALC:PEAK

Query

```
CALC:PEAK:MAX|MIN?
```

Description

This query returns the value of the peak-hold function.

- MAX returns the maximum recorded value
- MIN returns the minimum recorded value

Example

```
-> CALC:PEAK:MAX?
<- +2.83752000E+00
```

Returns the maximum peak-hold value

CONF?

Query

```
CONF? [@2]
```

Description

This query returns a series of comma-separated fields indicating the present measurement function of the primary or secondary display.

The query is returned in the following format string: <“Function”, “Range”, “Resolution”>.

When the @2 parameter is omitted, the query returns the function of the primary display.

Example

```
-> CONF?                                    Returns the function of the primary display
<- VOLT:AC +6.00000000E+01,+1.00000000E-03
```

FETC?

Syntax

```
FETC? [@2|@3]
```

Description

This query returns the value of the primary or secondary display.

When the @2 parameter is omitted, the query returns the value of the primary display.

The @3 parameter corresponds to the environment temperature.

Example

```
-> FETC?
<- +1.23475000E+00
```

Returns the value of the primary display.

INIT

Syntax

```
INIT
```

Description

This command removes the trigger hold system from the idle state and re-triggers the system.

Example

`-> TRIG:SOUR:BUS`	Enters the trigger hold mode.
`-> INIT`	Removes the trigger hold mode from the idle state and re-triggers the system.
`-> FETC?`	Returns the value of the primary display.
`<- +1.23266000E+00`	

Remarks

This command is only available in trigger hold mode.

READ?

Syntax

```
READ?
```

Description

This query returns a value after the re-trigger cycle when in the trigger hold mode.

When not in the trigger hold mode, this query returns the display value.

Example

```
-> TRIG:SOUR:BUS
```

Enters the trigger hold mode.

```
-> READ?
```

Returns a value after the re-trigger cycle when in the trigger hold mode, or the display value when not in the trigger hold mode.

```
<- -1.20000000E-01
```

STAT?

Syntax

STAT?

Description

This query returns the status of the U1281A/U1282A in the following format string:

<ABCDEFGHIJKLMNOPQRSTU>

Each of the letters represented in the format string are explained below:

Letter	Parameter	Description
A	Average function	0 : Off 1 : On
B	Null function	0 : Off 1 : On
C	dB function	0 : Off M : dBm V : dBV
D	Terminal alert	0 : Off 1 : On
E	Peak-hold function	0 : Off 1 : On
F	Current percent	0 : Off 1 : 4-20 mA 2 : 0-20 mA
G	Pulse width and duty trigger level	0 : Negative 1 : Positive
H	Trigger Hold function	0 : Off 1 : On
I	0 ^{o}C temperature compensation	0 : Off 1 : On

Letter	Parameter	Description
J	Beep initial driving frequency	0 : Off 1 : 3200 Hz 2 : 3268 Hz 3 : 3339 Hz 4 : 3413 Hz 5 : 3491 Hz 6 : 3572 Hz 7 : 3657 Hz 8 : 3746 Hz 9 : 3840 Hz A : 3938 Hz B : 4042 Hz C : 4151 Hz D : 4267 Hz.
K	Auto power-off status	0 : Off 1 : On
L	Auto Hold function	0 : Off 1 : On
M	Meter mode	L : Normal C : Calibration
N	Voltage alert	0 : Off 1 : On
O	Reserved	For future use
P	Rotary position	0 : ACV measurement 1 : ACmV measurement 2 : ACDCV measurement 3 : ACDCmV measurement 4 : Ω/nS measurement 5 : Diode measurement 6 : CAP/temperature measurement 7 : µA/mA measurement 8 : Current measurement 9 : SQU output
Q	Battery type	0 : Primary 1 : Secondary (rechargeable)
R	Battery level	0 : Normal 1 : Low
S	Resolution	0 : Five decimal places 1 : Four decimal places
T	AC Low Pass Filter status	0 : Off 1 : On
U	DC Filter status	0 : Off 1 : On

Example

```
-> STAT?                                  Returns the status of the U1281A/U1282A
<- 000000000910L00200000
```

SYST:BATT?

Syntax

```
SYST:BATT?
```

Description

This query returns the residual capacity of the battery in the U1281A/U1282A.

Example

```
-> SYST:BATT?

<- 100%
```

Returns the residual capacity of the battery currently in the U1281A/U1282A.

TRIG:SOUR

Syntax

```
TRIG:SOUR <BUS|REF|IMM>
TRIG:SOUR?
```

Description

This command is used to enter or exit the trigger hold mode or the auto hold mode.

The query returns the type of the trigger source.

Parameters

Item	Range of values	Description
character_data	BUS	Enters the trigger hold mode
	REF	Enters the auto hold mode
	IMM	Exits either the trigger hold mode or the auto hold mode

Example

```
-> TRIG:SOUR:REF
```
Enters the auto hold mode.

```
-> TRIG:SOUR?
```
Returns the type of the trigger source.

```
<- REF
```

Remarks

The average and peak functions are disabled when you enter either trigger hold mode or auto hold mode.

TRIG:REF:COUN

Syntax

```
TRIG:REF:COUN <numeric_value>
TRIG:REF:COUN?
```

Description

This command is used to set the auto hold mode count.

The query returns the auto hold mode count.

Parameters

Item	Range of values	Description
numeric_value	0	Enables the trigger hold mode
	1 ~ 9999	Enables the auto hold mode The default value is 50

Example

```
-> TRIG:REF:COUN 50
```
Sets a count of 50 to the auto hold mode.

```
-> TRIG:REF:COUN?
```
Returns the auto hold mode count.

```
<- +5.00000000E+01
```

Remarks

The count will be stored in the non-volatile memory, but the “0” parameter will not.

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