HIOKI

REMOTE OPERATION MANUAL

7016

SIGNAL SOURCE

HIOKI E. E. CORPORATION

Contents

Contents

Introduction

The Section describes how to operate the meter via an optical interface.

- It also explains the detail information of all interface command sets of Standard Commands for Programmable Instruments (SCPI) used in the meter.
- The remote control operation enables the user either to manually operate the meter via a terminal or to execute a host computer program automatically.

Symbols

Safety Symbol

The following symbols in this manual indicate the relative importance of cautions and warnings.

NOTE	Indicates advisory items related to performance or correct operation of the instrument.

Other symbols

❖	Indicates the reference.
*	Iterminology explained at the bottom of the word.

2 Symbols

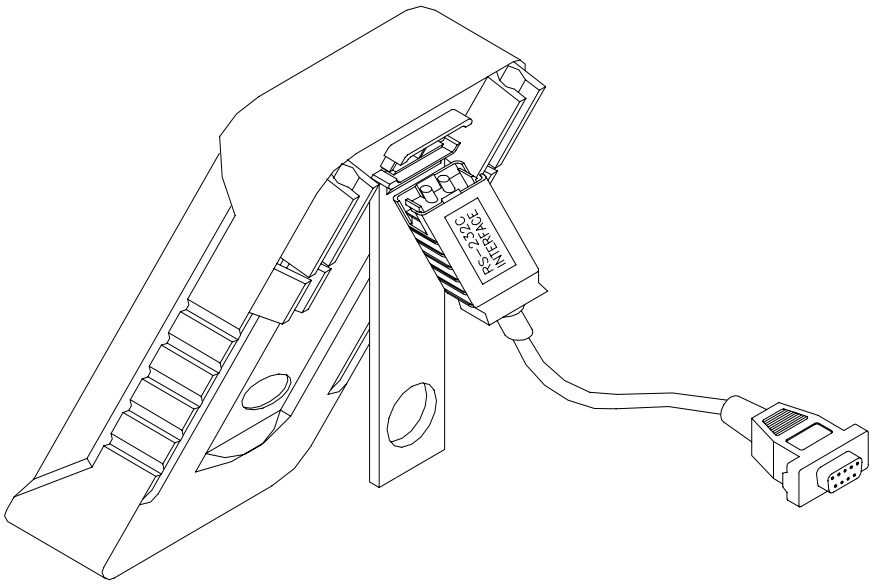
Remote Interface Overview

Chapter 1

The following figure shows the USB type optical cable connecting for the meter and a host computer communication.

The computer is added a virtual RS-232 COM port when the user plugs the USB type cable and installs the USB driver.

- The remote interface is a serial binary data interchange, which operates from 2400 to 19200 baud rate.
- The communication port of the 7016 is designed in full duplex, which makes the meter more reliable and efficient in data taking.



Cable connection for Communication

Setting Remote Interface Parameters Chapter 2

In order to operate the meter via a host computer or terminal, the parameters in interface within the 7016 have to match the parameters in the serial interface provided by the host or terminal.

The following procedures will guide the user to set up interface parameters within the 7016 to comply interface with the host.

The default settings of the meter at factory are 9600-baud rate, non-parity, 8 data bits, and 1 stop bit (9600, n, 8, 1).

The following table indicates the factory settings and user selectable communication parameters by using remote interface.

Remote Interface Parameters

Item	Parameter	Factory Setting	Selectable Parameter
1	Baud Rate	9600	2400, 4800, 9600, 19200
2	Parity	None	None, Odd or Even
3	Data Bit	8	7 or 8
4	ECHO	OFF	ON or OFF
5	Print-Only	OFF	ON or OFF

Echo

With ECHO ON, the meter echoes (returns) all the characters whatever it receives.

Print-Only

- The remote indicator of the 7016 is flashing when the meter is set to Print-Only ON.
- If the remote interface of the 7016 is under Print-Only mode, the 7016 will print out the measured data when the measurement cycle is completed.
- The 7016 auto-sends the newest data to a host continuously.
- The 7016 doesn't accept any commands under Print-Only mode.

Setup Procedures for Communication Parameter

To ensure the remote interface will operate appropriately, user may need to configure the remote interface parameters on Setup Mode. Please refer to operation procedures of POWER-ON OPTION.

❖ 7016 instruction manual 5.4 Power-On Options

Commands Summary Chapter 3

Overview of Command Type and Format

- All commands must be entered in the upper case.
- There are two types of the 7016 programming commands: IEEE 488 common commands and Standard Commands for Programmable Instruments (SCPI).
- Some commands are device-specific to the 7016. They are not included in the version 1999.0 of the SCPI standard. However, these commands are designed with the SCPI format in mind and they follow the syntax rules of the standard.

Common Command Format

- The IEEE 488 standard defines the common commands as commands that perform functions like reset and system query.
- Common commands usually come with the asterisk "*" character, and may include parameters. Some examples of Common command like: *IDN?, *RST, *CLS, GTL, LLO.

SCPI Command Format and Query Format

- The SCPI 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 command and its associated query:

A. **CONFigure:VOLTage:DC 0.5**: Set the primary display to the DC voltage measurement , and select the 500mV range.
B. **CONFigure?** : Return the function of the primary display measurement.

- CONFigure is a root level keyword with the second level keyword, VOLTage, and 0.5 is the command parameter.
- The query command ends with a question mark "?".

NOTE

SCPI stems from IEEE488.1 and IEEE 488.2. Although the IEEE 488.2 standard addressed some instrument measurements, it principally dealt with common commands and syntax or data formats. Please refer to the IEEE488.2 and SCPI reference manual for more information.

Terminator

A terminator is a character sent by a host, which identifies the end of a command string. A valid terminator consists of two-byte data:

<CR> (Carriage Return, ASC(&H0D))
<LF> (Line Feed, ASC(&H0A))

Responding Message

Chapter 4

Return result

- After the meter executes a query command the return of the result will be in the following format:

<Result> + <CR> <LF>

- If communication of the meter is under print-only mode, the meter will print out the measured data when the measurement cycle is completed. The printed data are only for primary display.
  The format of printed data will be shown as following:

<Measurement Data> + <CR> <LF>

- On the meter warning the return of the prompt will be in the following format except Xon and Xoff:

<Prompt> + <CR> <LF>

Data Types

- Returned message is the ASC II string from the meter responding to a query.
- A query is a command followed by a question mark.

The following table is explanation for data types.

Data Types of Responding Message and Parameter

Data Type	Explanation	Example
<NR1>	An integer	+10000, -10000, 123, -100
<NR2>	This numeric representation has an explicit radix point.	+13.234, -.00002, 3.4567
<NR3>	This representation has an explicit radix point and an exponent.	-1.20000000E+02, +9.90000000E+37*
<Boolean>	Single ASCII-encoded byte, is return for the setting query.	0 or 1,OFF or ON

Data Types of Responding Message and Parameter

Data Type	Explanation	Example
<Literal>	ASCII-encoded bytes corresponding to the short form of the literal used as the command parameter.	DCV, ACA
***: +9.90000000E+37 means positive overload, -9.90000000E+37 means negative overload.**		

Prompts

When the meter comes up any system warnings, the meter sends a prompt string to the host through remote interface.

The meter returns one of the prompts as shown on the following table.

Return Prompts

Prompts	Description
***L**	Into local mode
***C**	Into calibration mode
***E**	Remote command's error warning
***B**	Battery low warning
***I**	Input warning
***O**	Output warning
***0**	Rotary position: Voltage input & Pulse output
***1**	Rotary position: Voltage input & Current output
***2**	Rotary position: Voltage input & Voltage output
***3**	Rotary position: mV input & Voltage output
***4**	Rotary position: Resistance input & Voltage output
***5**	Rotary position: Diode input & Current output
***6**	Rotary position: Current input & Voltage output
***7**	Rotary position: Current input & Current output
***8**	Rotary position: Current input & Pulse output
ASC(&H11)	Xon: The meter is available.
ASC(&H13)	Xoff: The meter is busy.

Instructions of Command Sets Chapter 5

5.1 IEEE 488 Common Commands

***CLS**

Description	Clear the System Error Queue.

***IDN?**

Description	Query the Meter identification.
Response	Returns instrument maker name, model number, serial number and firmware version.

***RST**

Description	Put the meter to power-on-reset state, but no affect the Output Queue and interface parameter.

NOTE

The reset operation is executed for 3 seconds at least. Be sure to execute other commands then.

LLO

Description	Put the meter into the local lockout state when in remote control. This means no local key operation at the front panel is allowed during remote control.

GTL

Description	Put the meter into the local state, clearing the remote state and front panel lockout.

5.2 SCPI Commands

This subsection describes the SCPI subsystem commands for the meter. The meter only accepts the UPPER CASE part of command. It is unnecessary to send complete command characters.

Some SCPI Symbol Conventions

Text Symbol	Meaning
[ ]	Option: can be omitted
|	Exclusive OR
< >	Defined element
( )	Comment
?	Question mark
:	Separated two command keywords
;	Compound commands

CONFigure Subsystem:

CONFigure
[:SCALar]
:CURRent
:DC [<range>]
:AC [<range>]
:ACDC [<range>]
:DCAC [<range>]

Description	• Set to DC, AC or AC+DC current measurement. • The function switch is at current measuring.
Parameter	• If parameter is omitted, the meter is set to auto range. • Enter the current measurement range to <range>.: 0.05* or 0.5* *0.05: 50 mA, 0.5: 500 mA
Example	**CONF:CURR:DC** : Set to DC current. **CONF:CURR:AC 0.5** : Set to AC current and 500 mA range.

CONFigure[:SCALar]:CPERcent < 0-20mA | 4-20mA >

Description	• Set to the DCmA percent measurement. • The function switch is at current measuring.
Parameter	• Value to be entered to < >: 0-20mA* or 4-20mA* *0-20mA: 0 mA (0%) to 20 mA (100%), 4-20mA: 4 mA (0%) to 20 mA (100%)
Example	**CONF:CPER 4-20mA**: Set to DC 4-20 mA.

CONFigure
[:SCALar]
:VOLTage
:DC [<range>]
:AC [<range>]
:ACDC [<range>]
:DCAC [<range>]

Description	• Set to DC, AC or AC+DC voltage measurement. • The function switch is at mV measuring or V measuring.
Parameter	• If parameter is omitted, the meter is set to auto range. • Enter the voltage measurement range to <range>.: The function switch is at mV measuring: 0.05* or 0.5* The function switch is at V measuring : 5, 50, or 250 *0.05 : 50 mV, 0.5: 500 mV
Example	**CONF:VOLT:DC** : Set to DC voltage measuring. **CONF:VOLT:ACDC 0.5**: Set to AC+DC voltage and 500 mV range.

CONFigure[:SCALar]:FREQuency [<range>]

Description	• Set to frequency measurement and enable dual display mode. • The function switch is at voltage or current measuring
Parameter	• If parameter is omitted, the meter is set to auto range. • Enter the frequency measurement range to <range>. (Unit: Hz):100, 1000 (1KHz), 10KHz, 100KHz, or 200KHz
Example	**CONF:FREQ 1000** : Set to frequency measuring and 1 kHz range.

CONFigure
[:SCALar]
:PULSe
:PWIDth [<range>]
:NWIDth [<range>]
:PDUTycycle
:NDUTycycle

Description	• Set to pulse measurement and enable dual display mode. • The function switch is at voltage or current measuring.
Parameter	• If parameter is omitted, the meter is set to auto range. • Enter the pulse measurement range to <range>. (Unit: s): 0.5*or 5 *0.5: 500 ms
Example	**CONF:PULS:PWID** : Set to positive pulse width measuring. **CONF:PULS:NDUT**: Set to negative pulse duty measuring.

CONFigure[:SCALar]:RESistance [<range>]

Description	• Set to 2-wire resistance measuring. • The function switch is at resistance measuring.
Parameter	• If parameter is omitted, the meter is set to auto range. • If parameter is omitted, the meter is set to auto range. • Enter the resistance measurement range to <range>. (Unit: Ω): 500, 5000 (5Kohm), 50Kohm, 500Kohm, 5Mohm, or 50Mohm
Example	**CONF:RES 50Kohm** : Set to resistance measuring and 50 kΩ range.

CONFigure[:SCALar]:CONTinuity [<range>]

Description	• Set to 2-wire resistance measuring with the continuity test. • The function switch is at resistance measuring.
Parameter	• If parameter is omitted, the meter is set to auto range. • Enter the resistance measurement range to <range>. (Unit: Ω): 500, 5000 (5Kohm), 50Kohm, 500Kohm, 5Mohm, or 50Mohm.
Example	**CONF:CONT 500** : Set to resistance measuring with the continuity test and 500 Ω range.

CONFigure[:SCALar]:DIODe

Description	• Set to diode measuring with continuity test. • The function switch is at diode measuring.

CONFigure[:SCALar]:TEMPerature

Description	• Set to temperature measuring with continuity test. • The function switch is at mV measuring.
Example	CONF:TEMP TC,K,CEL: Set to temperature measuring, thermocouple K type and Celsius unit.

CONFigure? [@2]

Description	Query the function of the primary or secondary display.
Parameter	If parameter is omitted, query the function of the primary display.
Response	Return <"function range,resolution"> format string, the examples are as following:

Example	Function	Range	Resolution
VOLT +5.000000E-02,+1.000000E-06	DCV	50 mV	0.001 mV
VOLT:ACDC +5.000000E-00,+1.000000E-04	AC+DCV	5 V	0.0001 V
CURR:AC +5.000000E-01,+1.000000E-05	ACA	500 mA	0.01 mA
CPER:0-20mA	Current percent: 0-20mA		
FREQ +1.000000E+03,+1.000000E-02	Frequency	1 kHz	0.01 Hz
PULS:PWID +5.000000E+00,+1.000000E-04	Pulse width(Positive)	5000 ms	0.1 ms
PULS:NDUT	Pulse duty(Negative)		
RES +5.000000E+04,+1.000000E+00	Resistance	50 kΩ	1 Ω
CONT +5.000000E+02,+1.000000E-02	Continuous	500 Ω	0.01 Ω
DIOD	Diode		
TEMP:TC K CEL	Temperature		

NOTE

- If query the secondary function and the secondary is not set, the meter returns an error prompt to the host.
- The secondary function is enabled by sending **CONF:FREQ** or **CONF:PULS** command. Original primary function changes to secondary function, and the primary function is replaced by frequency or pulse function.

CALCulate Subsystem:

CALCulate:FUNCtion < AVERage | PEAKhold | NULL | NONE>

Description	Set or off the function of the calculation.
Parameter	**AVER** - average (record) function **PEAK** - peak-hold function **NULL** - null (relative) function **NONE** - off all calculation function.
Example	**CALC:FUNC AVER**

NOTE

In general, these functions can't be combined. Only it is available that set the **AVER** function first and then set the **NULL** function. The **REF** and **BUS** trigger mode will be disabled when the calculation function is enabled.

CALCulate:FUNCtion?

Description	Query the function of the calculation.
Response	Return <Literal> format string: **AVER**, **PEAK**, **NULL** or **NONE**.
Example	Returning **AVER**,**NULL** means the record function and the relative function being enabled.

CALCulate:NULL:OFFSet?

Description	Query the offset value of the null (relative) function.
Response	Return <NR3> format string.

CALCulate
:AVERage
:MAXimum?
:MINimum?
:AVERage?
:PRESent?
:COUNt?

Description	Query the value of the dynamic recording function.
Response	Return <NR3> format string.
Example	**CALC:AVER:MAX?** : Query the maximum measuring value. **CALC:AVER:MIN?** : Query the minimum measuring value. **CALC:AVER:AVER?** : Query the average measuring value. **CALC:AVER:PRES?** : Query the present measuring value. **CALC:AVER:COUN?**: Query the count value of the average mode.

CALCulate
:PEAKhold
:MAXimum?
:MINimum?

Description	Query the value of the peak-hold function.
Response	Return <NR3> format string.
Example	**CALC:PEAK:MAX?**: Query the maximum peak-hold value. **CALC:PEAK:MIN?** : Query the minimum peak-hold value.

TRIGger Subsystem:

TRIGger:SOURce < BUS | REFreshhold | IMMediate >

Description	Select the source of the start trigger signal.
Parameter	**BUS** - select a bus command and enter the trigger (hold) mode. **REF** - select a refresh-hold trigger source and enter the trigger mode **IMM** - select the internal trigger source and escape the trigger mode.
Example	**TRIG:SOUR BUS**

NOTE

- The calculation function would be disabled when enter trigger mode.
- The count of the refresh-hold mode must be set first on the parameter being BUS or REF.
- When the count of the refresh-hold mode is zero, the parameter REF is invalid. Contrary, the parameter BUS is invalid when the count of the refresh-hold mode is not zero.

TRIGger:SOURce?

Description	Query the type of the trigger source.
Response	Return <Literal> format string: **BUS**, **REF**, **IMM**

TRIGger:REFreshhold:COUNt <numeric>

Description	Set the count of the refresh-hold mode.
Parameter	<numeric>: 0, 100, 200, 300, 400, 500, 600, 700, 800, 900, 1000. The other numeric would be rounded down to valid value.

NOTE

Stored in non-volatile memory.

TRIGger:REFreshhold:COUNt?

Description	Query the count of the refresh-hold mode.
Response	Return <NR1> format string: 0 to 1000.

ABORt

Description	The command resets the trigger system and places all trigger sequences in the idle state. This command is an event and has no associated *RST condition or query form.

INITiate[:IMMediate]

Description	The command causes all sequences to exit the idle state and the trigger system to initiate and complete one full trigger cycle, returning to idle on completion. If the device is not in idle or if the source of the trigger is set to immediate, the command has no effect on the trigger system and an error -213 is generated. I NITiate:IMMediate is an event and cannot be queried as there is no state associated with it.

Measuring Subsystem:

FETCh? [@2]

Description	• Return the primary or secondary function value of output buffer. • Retrieves the measurements taken by the INITiate command and places them into the device's output buffer. • The query will return data any time that the last reading is valid. • The meter produces an Error 230 in the following case, and no result is returned: When invalid data is present while awaiting a trigger event (such as when the range is changed while the Hold function is enabled).
Parameter	If parameter is omitted, the meter returns the primary function value.
Response	Return <NR3> format string.
Example	**FETC? @2**: Return the value, e.g. **+1.23450000E+00**

NOTE

- If query the secondary function value and the secondary is not set, the meter returns an error prompt to the host.
- The secondary function is enabled by sending **CONF:FREQ** or **CONF:PULS** command. Original primary function changes to secondary function, and the primary function is replaced by frequency or pulse function.

READ?

Description	• Return the primary function value of output buffer after the next triggered measurement is complete. • The command provides a method of performing a **FETC?** operation on fresh data. • The query command is identical to: **ABOR**; **INIT**; **FETC?**. The command is like FETCh? on the immediate trigger mode.
Response	Return <NR3> format string.

SOURce Subsystem:

[SOURce:]VOLTage[:LEVel][:IMMediate][:AMPLitude] <level>

Description	Set the amplitude of the voltage output.
Parameter	String to be entered to <level>: format s#.####*1 or format s##.###*2 *1 s#.####:for range -1.5000 to +1.5000 V *2 s##.###:for range -15.000 to +15.000 V
Example	**VOLT +01.000**

NOTE

The different level format setting will change the range of voltage output. The output of the instrument switches to standby state on changing the range of voltage output.

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

Description	Query the amplitude of the voltage output.
Response	Return <NR3> format string.

[SOURce:]VOLTage:RANGe < 1.5 | 15 >

Description	Set the range of the voltage output.
Parameter	Value to be entered to < >: 1.5* or 15* *1.5: 1.5 V range (-1.5000 to +1.5000 V), 15 : 15 V range(-15.000 to +15.000 V)
Example	**VOLT:RANG 1.5**

[SOURce:]VOLTage:RANGe?

Description	Query the range of the voltage output.
Response	Return <Literal> format string: 1.5 or 15.

[SOURce:]VOLTage:RAMP:STARt <level>,<resolution>

Description	Set the start position of the voltage RAMP function.
Parameter	String to be entered to <level>: format s#.####*1 or format s##.###*2 *1 s#.####:for range -1.5000 ~ +1.5000 V *2 s##.###:for range -15.000 ~ +15.000 V • Value to be entered to <resolution>: 1 to 999
Example	**VOLT:RAMP:STAR -1.0000,100**: start from -1V (range 1.5V), 100 step resolution.

NOTE

- Stored in non-volatile memory.
- There are two voltage RAMP tables in the instrument. Only one of voltage RAMP tables can be executed by voltage range setting. The settings are stored to range 1.5V RAMP table on using format s#.####.
  On the other hand, the settings are stored to range 15V RAMP table on using format s##.###.
  The different level format setting will change the range of voltage output.
  For example,
  VOLT:RAMP:STAR +1.5000,10; 1.5V RAMP table
  VOLT:RAMP:STOP +05.000,10 ; 15V RAMP table
  The output is going to follow the settings of 15V RAMP table.

[SOURce:]VOLTage:RAMP:STOP <level>,<resolution>

Description	Set the stop position of the voltage RAMP function.
Parameter	String to be entered to <level>: format s#.####*1 or format s##.###*2 *1 s#.####:for range -1.5000 ~ +1.5000 V *2 s##.###:for range -15.000 ~ +15.000 V • Value to be entered to <resolution>: 1 to 999
Example	**VOLT:RAMP:STOP -1.0000,100**: stop to -1V (range 1.5V), 100 step resolution.

NOTE

Stored in non-volatile memory.

[SOURce:]VOLTage:RAMP:ONCE <Boolean>

Description	Set the cycle mode of the voltage RAMP function and activate output.
Parameter	String to be entered to <Boolean>: 1* or 0 * * 1 : one cycle, 0 : continuous

[SOURce:]VOLTage:RAMP:ONCE?

Description	Query the cycle mode of the voltage RAMP function.
Response	Return 0* or 1* *0 : continuous, 1 : one cycle

[SOURce:]VOLTage:SCAN[:TABLe] <step>,<level>,<second>

Description	Set the table of the voltage SCAN function and the time of output.
Parameter	• Value to be entered to <step>: 1 to 16 String to be entered to <level>: format s#.####*1 or format s##.###*2 *1 s#.####:for range -1.5000 to +1.5000 V *2 s##.###:for range -15.000 to +15.000 V • Value to be entered to<second>: 0 to 99 (s)
Example	**VOLT:SCAN 6,+02.000,5**: step 6, +2V(range 15V table), 5 seconds.

NOTE

- Stored in non-volatile memory.
- There are two voltage SCAN tables in the instrument. Only one of voltage SCAN tables can be executed by voltage range setting. The settings are stored to range 1.5V SCAN table on using format s#.####.
  On the other hand, the settings are stored to range 15V SCAN table on using format s##.###. The different level format setting will change the range of voltage output. For example,
  VOLT:SCAN 1,+1.5000,5 ; 1.5V SCAN table
  VOLT:SCAN 2,+05.000,5 ; 15V SCAN table
  The output is going to follow the settings of 15V SCAN table.

[SOURce:]VOLTage:SCAN:STEP < 1 Å` 16 | +1 | -1 >

Description	Select the step of the voltage SCAN function to be output.
Parameter	**1 ～ 16** - fixed step **+1** - next step **-1** - previous step
Example	**VOLT:SCAN:STEP 8**: set to the step 8 of the voltage SCAN function.

[SOURce:]VOLTage:SCAN:STEP?

Description	Query which the step of the voltage SCAN function.
Response	Return <NR1> format string: 1 to 16.

[SOURce:]VOLTage:SCAN:ONCE <Boolean>

Description	Set the cycle mode of the voltage SCAN function and activate output.
Parameter	Value to be entered to <Boolean>:1* or 0 * * 1 : one cycle, 0 : continuous

[SOURce:]VOLTage:SCAN:ONCE?

Description	Query the cycle mode of the voltage SCAN function.
Response	Return 0* or 1* *0 : continuous, 1 : one cycle

[SOURce:]CURRent[:LEVel][:IMMediate][:AMPLitude] <level>

Description	Set the amplitude of the current output.
Parameter	String to be entered to <level>: format s##.###* *format s##.### : -25.000 to +25.000 mA
Example	**CURR +01.000**

[SOURce:]CURRent[:LEVel][:IMMediate][:AMPLitude]?

Description	Query the amplitude of the current output.
Response	Return <NR3> format string.

[SOURce:]CURRent:RANGe < 0.025 \| 25mA >

Description	Set the range of the current output.
Parameter	0.025* or 25 mA* 0.025: range -25.000 to +25.000 mA 25mA: range -25.000 to +25.000 mA
Example	**CURR:RANG 0.025**

[SOURce:]CURRent:RANGe?

Description	Query the range of the current output.
Response	Return <Literal> format string: 0.025.

[SOURce:]CURRent:RAMP:STARt <level>,<resolution>

Description	Set the start position of the current RAMP function.v
Parameter	• String to be entered to <level>: format s##.###* *format s##.### : -25.000 to +25.000 mA • Value to be entered to <resolution>: 1 to 999.
Example	**CURR:RAMP:STAR -10.000,100**: stop to -10mA (range 25mA), 100 step resolution.

NOTE

Stored in non-volatile memory.

[SOURce:]CURRent:RAMP:STOP <level>,<resolution>

Description	Set the cycle mode of the current RAMP function and activate output.
Parameter	• String to be entered to <level>: format s##.###* *format s##.### : -25.000 to +25.000 mA • Value to be entered to <resolution>: 1 to 999
Example	**CURR:RAMP:STOP -10.000,100**: stop to -10mA (range 25mA), 100 step resolution.

NOTE Stored in non-volatile memory.

[SOURce:]CURRent:RAMP:ONCE <Boolean>

Description	Set the cycle mode of the current RAMP function and activate output.
Parameter	String to be entered to <Boolean>: 1* or 0 * * 1 : one cycle, 0 : continuous

[SOURce:]CURRent:RAMP:ONCE?

Description	Query the cycle mode of the current RAMP function.
Response	Return 0* or 1* *0 : continuous, 1 : one cycle

[SOURce:]CURRent:SCAN[:TABLe] <step>,<level>,<second>

Description	Set the table of the current SCAN function.
Parameter	• Value to be entered to <step>: 1 to 16 • String to be entered to <level>: format s##.###* *format s##.### : -25.000 to +25.000 mA • Value to be entered to <second>: 0 to 99.
Example	**CURR:SCAN 6,+02.000,5**: step 6, +2mA(range 25mA), 5 seconds.

NOTE Stored in non-volatile memory.

[SOURce:]CURRent:SCAN:STEP < 1 Å` 16 | +1 | -1 >

Description	Set the step value of the current SCAN function.
Parameter	**1 ~ 16**- fixed step **+1** - next step **-1** - previous step
Example	**CURR:SCAN:STEP 8** : set to the step 8 of the current SCAN function.

[SOURce:]CURRent:SCAN:STEP?

Description	Query the step value of the current SCAN function.
Response	Return <NR1> format string: 1 to 16.

[SOURce:]CURRent:SCAN:ONCE <Boolean>

Description	Set the cycle mode of the current SCAN function and activate output.
Parameter	String to be entered to <Boolean>: 1* or 0 * *1 : one cycle, 0 :continuous

[SOURce:]CURRent:SCAN:ONCE?

Description	Query the cycle mode of the current SCAN function.
Response	Return 0* or 1* *0 :continuous, 1 : one cycle

[SOURce:]SQUare:DCYCle:DECimal <numeric>

Description	• Set the duty cycle of the square wave. • Duty cycle = numeric / 256
Parameter	Value to be entered to <numeric>: 1 to 255
Example	**SQU:DCYC:DEC 64**: The duty cycle is 25%.

[SOURce:] SQUare:DCYCle?

Description	Query the setting value of the duty cycle of the square wave.
Response	Return <NR1> format string: 1 to 255.

[SOURce:]SQUare:PWIDth:DECimal <numeric>

Description	• Set the pulse width of the square wave. • Pulse width = numeric / (frequency x 0.256)
Parameter	Value to be entered to <numeric>: 1 to 255.
Example	**SQU:PWID:DEC 64**: The pulse width is approx 0.42 ms on 600 Hz.

[SOURce:] SQUare:PWIDth?

Description	Query the setting value of the pulse width of the square wave.
Response	Return <NR1> format string: 1 to 255.

[SOURce:]SQUare:FREQuency <numeric>

Description	Set the frequency of the square wave.
Parameter	<numeric>: 0.5, 1, 2, 5, 10, 15, 20, 25, 30, 40, 50, 60, 75, 80, 100, 120, 150, 200, 240, 300, 400, 480, 600, 800, 1200, 1600, 2400, 4800. The other numeric is invalid value.
Example	**SQU:FREQ 600**: Set the frequency at 600 Hz.

[SOURce:] SQUare:FREQuency?

Description	Query the frequency of the square wave.
Parameter	Return <NR1> or <NR2> format string: 0.5 to 4800.

[SOURce:]SQUare:AMPLitude < +5V | 10V | +12V | 24V >

Description	Set the amplitude of the square wave.
Parameter	+5V*, 10V*, +12V*, or 24V* *+5V: 0 V to +5V, 10V: -5V to +5V, +12V: 0V to +12V, 24V: -12V to +12V
Example	**SQU:AMPL +12V**: Set the amplitude of the square wave at 0 to +12 V.

[SOURce:] SQUare:AMPLitude?

Description	Query the amplitude of the square wave.
Response	Return <Literal> format string: +5V, 10V, +12V or 24V.

SOURce?

Description	Query the output function.
Response	Return <"function amplitude[,frequency,duty]"> format string, the examples are as following:

Example	Function	Amplitude	Frequency duty
VOLT -1.000000E+00	Voltage	-1 V	
VOLT:RAMP +2.000000E-01	Voltage:RAMP	0.2 V	
CURR:SCAN +4.000000E-03	Current:SCAN	4 mA	
SQU +1.000000E+01,+1.200000E+03,5.000000E+01	Square wave	10 V	1200 Hz, 50%

OUTPut[:STATe] <Boolean>

Description	Activate or stand-by the output.
Parameter	Value to be entered to <Boolean>: 1* or 0 * * 1 : activate 0 : stand-by

NOTE

The SCAN or RAMP output will be restart on activating output.

OUTPut[:STATe]?

Description	Query the state of the output.
Response	Return 0* or 1* *0 : stand-by, 1 : activate

SYSTem Subsystem:

DISPlay:TEXT <"string">

Description	Set the text of the primary display.
Parameter	• The five characters in front are valid. The too many characters would be round off. The insufficient character would be replaced by space character. • Accept any numeral or capital letter. The undefined character would be displayed space.
Example	**DISP:TEXT "DONE"**

DISPlay:TEXT:CLEar

Description	Clear the text of the primary display and recover the original display mode.

SYSTem:BEEPer [< CONTinous | STOP | TONE >]

Description	• Set the action of the beeper. • Ignore the original state of the beeper.
Parameter	If parameter is omitted, the meter is set to tone. **CONT** - beep continuously. **STOP** - stop to beep. **TONE** - beep one tone.
Example	**SYST:BEEP**

SYSTem:BLIT[:STATe] <Boolean>

Description	Enable or disable the back lit.
Parameter	Value to be entered to<Boolean>: 1* or 0* *1:ON, 0:OFF

NOTE The backlit will be auto turned off depending on below time setting. To turn off backlit by this command once the time is set to "0".

SYSTem:BLIT:TIME <second>

Description	Set the time of the back lit.
Parameter	Value to be entered to <second>: 0 to 99 (Set "0" to disable auto turning off backlit.)

NOTE Stored in non-volatile memory.

SYSTem:AOFF:TIME <minute>

Description	Set the time of the auto power off function.
Parameter	Value to be entered to <minute>:0 to 99 (Set "0" to disable auto power off function.)

NOTE Stored in non-volatile memory.

SYSTem:TCOMpensated[:STATe] <Boolean>

Description	Enable or disable the "0°C" temperature compensation.
Parameter	Value to be entered to <Boolean>: 1* or 0* *1:ON, 0: OFF

SYSTem:VERSion?

Description	Query the version of the SCPI.
Response	Return 1999.0 string.

SYSTem:ERRor?

Description	Query the error message.
Response	Return <Number,"Error String"> format string. The following table is a list of SCPI error message that might occur during operation.

NOTE The buffer size of the system error queue is one.

SCPI Error Message

Number	Error String	Number	Error String
+0	No error	-213	Init ignoredInit
-100	Command error	-220	Parameter error
-200	Execution error	-230	Data stale

STATus Subsystem:

STATus?

Description	Query the status of the meter.
Response	Return <"ABCDEFGHIJKLMNOPQRSTU"> format string. Each character means as following:

	Item	Description
A	Average function	0: off, 1: on
B	Null function	0: off, 1: on
C	Unused	always 0
D	Unused	always 0
E	Peak-hold function	0 :off, 1: on
F	Unused	always 0
G	Trigger mode	I: IMM, B: BUS, R: REF
H	Slide switch position	0: meter/source, 1: meter only
I	0°C temperature compensation	0: off, 1: on
J	Beep	0: off, 1: 1 kHz, 2: 2 kHz, 4: 4 kHz, F: 600 Hz
K	Auto Power Off	0: off, 1:on
L	Back lit	0: off, 1:on
M	Meter mode	L: local, S: setup, C: Calibration
N	Input warning	0:normal, 1:warming
O	Output warning	0:normal, 1:warming
P	Rotary position	0: voltage input & pulse output 1: voltage input & current output 2: voltage input & voltage output 3: mV input & voltage output 4: resistance input & voltage output 5: diode input & current output 6: current input & voltage output 7: current input & current output 8: current input & pulse output
Q	Output status	0:stand-by, 1:operation
R	Rate	4:50000 counts
S	Battery	0:normal, 1:low
T	Unused	always 0
U	Auto range	0:off, 1:on

Summary of SCPI Commands

Chapter 6

Command	Parameter	Description
CONFigure?	[@2]	Query the function of the display.
CONFigure[:SCALar]		Configure the meter to perform specified measurement.
:VOLTage		Set the voltage measurement.
:AC	[<range>]	
:ACDC	[<range>]	
:DCAC	[<range>]	
:DC	[<range>]	
:CURRent		Set the current measurement.
:AC	[<range>]	
:ACDC	[<range>]	
:DCAC	[<range>]	
:DC	[<range>]	
:CPERcent	[<0-20mA|4-20mA>]	Set the DCmA percent measurement.
:FREQuency	[<range>]	Set the meter to frequency measurement.
:PULSe		Set the pulse measurement.
:PWIDth	[<range>]	Positive pulse width
:NWIDth	[<range>]	Negative pulse width
:PDUTycycle		Positive pulse duty
:NDUTycycle		Negative pulse duty
:RESistance	[<range>]	Set the resistance measurement.
:CONTinuity	[<range>]	Set the resistance measurement with the continuity test.
:DIODe		Set the diode measurement.
:TEMPerature		Set the temperature measurement.

Command	Parameter	Description
TRIGger		Trigger function
:SOURce?		Query the trigger source type.
:SOURce	<BUS|REF|IMM>	Select a trigger source.
:REF:COUNt?		Query the count of the refresh-hold mode.
:REF:COUNt	<numeric>: 0 to 1000	Set the count of the refresh-hold mode.
ABORt		Reset the trigger system of the meter.
INITiate[:IMMediate]		Initiate the trigger system of the meter.
FETCh?	[@2]	
READ?		Return the data any time that the last reading is valid.
CALCulate		
:FUNCtion?		Query the calculation function.
:FUNCtion	<function>	Set the calculation function.
:NULL:OFFSet?		Query the offset value of the relative function.
:AVERage **:MAXimum?** **:MINimum?** **:AVERage?** **:PRESent?** **:COUNt?**		Query the value of the dynamic recording function.
:PEAKhold **:MAXimum?** **:MINimum?**		Query the value of the peak-hold function.
OUTPut		
[:STATe]?		Query the state of the output function.
[:STATe]	<Boolean>	Activate or stand-by the output.

Command	Parameter	Description
SOURce?		Query the output function.
[SOURce:]VOLTage		Output voltage.
[:LEV][:IMM][AMPL]?		Query the amplitude of the output.
[:LEV][:IMM][AMPL]	<level>	Set the amplitude of the output.
:RANGe?		Query the range of the output.
:RANGe	<1.5|15>	Set the range of the output.
:SCAN		SCAN function.
[:TABLe]	<step>,<level>, <second>	Set the table of the SCAN function.
:STEP?		Query the step value of the SCAN function.
:STEP	<01 to 16|+1|-1>	Set the step value of the SCAN function.
:ONCE?		Query the cycle mode of the SCAN function.
:ONCE	<Boolean>	Set the cycle mode of the SCAN function.
:RAMP		RAMP function.
:STARt	<level>,<resolution>	Set the start point of the RAMP function.
:STOP	<level>,<resolution>	Set the stop point of the RAMP function.
:ONCE?		Query the cycle mode of the SCAN function.
:ONCE	<Boolean>	Set the cycle mode of the SCAN function.

Command	Parameter	Description
[SOURce:]CURRent		Output current.
[:LEV][:IMM][AMPL]?	<level>	Query the amplitude of the output.
[:LEV][:IMM][AMPL]		Set the amplitude of the output.
:RANGe?	<0.025|25mA>	Query the range of the output.
:RANGe		Set the range of the output.
:SCAN	<step>,<level>, <second>	SCAN function.
[:TABLe]		Set the table of the SCAN function.
:STEP?	<01 to 16|+1|-1>	Query the step value of the SCAN function.
:STEP		Set the step value of the SCAN function..
:ONCE?	<Boolean>	Query the cycle mode of the SCAN function.
:ONCE		Set the cycle mode of the SCAN function.
:RAMP	<level>,<resolution>	RAMP function.
:STARt	<level>,<resolution>	Set the start position of the RAMP function.
:STOP		Set the stop position of the RAMP function.
:ONCE?	<Boolean>	Query the cycle mode of the SCAN function.
:ONCE		Set the cycle mode of the SCAN function.
[SOURce:]SQUare		Output square wave.
:DCYCle?		Query the duty cycle of the square wave.
:DCYCle:DECimal	<numeric>: 1 to 255	Set the duty cycle of the square wave.
:PWIDth?		Query the pulse width of the square wave.
:PWIDth:DECimal	<numeric>: 1 to 255	Set the pulse width of the square wave.
:FREQuency?		Query the frequency of the square wave.
:FREQuency	<numeric>	Set the frequency of the square wave.
:AMPLitude?		Query the amplitude of the square wave.
:AMPLitude	<+5V|10V|+12V|24V>	Set the amplitude of the square wave.
DISPlay		
:TEXT	<string>	Set the text of the primary display.
:TEXT:CLEar		Clear the text of the primary display.

Command	Parameter	Descliption
SYSTem		
:AOFF:TIME	<minute>: 0 to 99	Set the time of the auto power off function.
:BEEPer	[<CONT|STOP|TONE>]	Set the action of the beeper.
:BLIT		
[:STATe]	<Boolean>	Enable or disable the back lit.
:TIME	<second>: 0 to 99	Set the time of the back lit.
:TCOM		
[:STATe]	<Boolean>	Enable or disable the 0°C temperature compensation.
:ERRor?		Query the error message.
:VERSion?		Query the version of the SCPI.
STATus?		Query the status of the meter.

Remote Program Example Using Visual Basic 6 Chapter 7

```
Private Sub Command1_Click()
' Create 3 objects on the Form:
' 1.TextBox- Text1
' 2.CommandButton- Command1
' 3. Microsoft Comm Control 6.0- MSComm1     added from Menu Bar / Project / Components
' The program fetches 10 readings from the meter and shows average value.

  MSComm1.CommPort = 1' set COM1 port
  MSComm1.PortOpen = True' open COM
  MSComm1.Settings = "9600,n,8,1"' Baud Rate 9600, Parity none, 8 data bits, 1 stop bit

  MSComm1.Output = "LLO" & vbCrLf' send Local lock command
  MSComm1.Output = "CONF:VOLT:DC 5" & vbCrLf' set DCV 5V function

  For i = 1 To 50000' wait for function ready
    DoEvents
  Next i

  buffer = MSComm1.Input' clear COM input buffer
  Text1.Text = "" clear display
  reading = 0' clear average value

  For i = 1 To 10
    MSComm1.Output = "FETC?" & vbCrLf' send Fetch command
    buffer = ""
    Do
      buffer = buffer & MSComm1.Input
    Loop While InStr(buffer, vbCrLf) = 0' receive reading
    reading = reading + Val(buffer)' sum reading
    Text1.Text = Text1.Text & "Reading" & i & " = " & buffer & vbCrLf  ' show reading
  Next i

  Text1.Text = Text1.Text & vbCrLf & "Average = " & (reading / 10) & vbCrLf' show average
```

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Remote Operation Manual

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