HIOKI

Operation Guide

7016

SIGNAL SOURCE

HIOKI E. E. CORPORATION

March 2009 Revised edition 1 7016A983-01 09-03H

Contents

Introduction

This manual describes the basic operation of HIOKI 7016 SIGNAL SOURCE.

❖Details→Instruction manual for the 7016

Symbols

❖	Indicates the reference.
	Indicates quick references for operation.

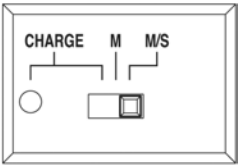
Source Function Chapter 1

Important!

- The yellow labels around the outer circumference of the function selector indicate signal source/generation
- functions.
- The [**SHIFT**] button must first be pressed to enable the source-related button functions.

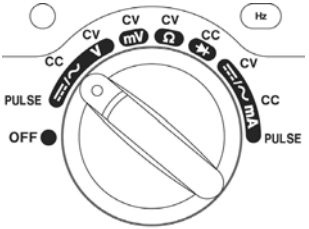
1.1 Basic Sourcing Procedure

1. Set the slide switch to the [**M/S**] position.



2. Set the function selector to the following position.

(ex. Sourcing constant-current)



Sourcing constant-voltage	[**CV**]
Sourcing constant-current	[**CC**]
Sourcing pulse	[**PULSE**]
Using memory function	Voltage source: [**CV**] Current source: [**CC**]

3. Press the [**SHIFT**] button and confirm that SHIFT is displayed on the LCD.

(Ex. Voltage Source)

The source-related button functions are now enabled.

4. Press the [**MODE**] button as necessary to select the source mode or the parameter on the secondary display.

5. Making the settings with the [◀], [▶], [▲], or [▼] button.

6. Press the [**OUTPUT**] button and output the setting value. Verify that OUT is displayed on the LCD.

(Ex. Voltage Source)

7. Press the [**OUTPUT**] button again to disable output. Verify that OUT is no longer displayed.

1.2 Constant-Voltage Source (DCCV)

This mode outputs a constant current at the set value regardless of load.

Procedure

1. Set the slide switch.	[**M/S**]
2. Set the function selector.	[**CV**]
3. Press the [**SHIFT**] button.	Confirm that SHIFT is displayed.
4. Press the [**MODE**] button as necessary to select the source mode on the secondary display.	**Source Mode** • Constant-voltage source 1.5 V range • Constant-voltage source 15 V range • Constant-voltage SCAN source 1.5 V range • Constant-voltage SCAN source 15 V range • Constant-voltage RAMP source 1.5 V range • Constant-voltage RAMP source 15 V range

5.	Select a digit to change.	With the [◀] or [▶] button

6.	Set a value.	With the [▲] or [▼] button

Settanble Ranges

[+0.0000 V] (1.5 V range)	-1.5000 V to 1.5000 V
[+00.000 V] (15 V range)	-15.000 V to 15.000 V

7.	Press the [**OUTPUT**] button to output the set voltage value.	Verify that OUT is displayed.

8.	Press the [**OUTPUT**] button again to disable output.	Verify that OUT is no longer displayed.

1.3 Constant-Current Source (DCCC)

This mode outputs a constant current at the set value regardless of load.

Procedure

1.	Set the slide switch	[M/S]
2.	Set the function selector.	[CC]
3.	Press the [SHIFT] button.	Confirm that SHIFT is displayed
4.	Press the [MODE] button as necessary to select the source mode on the secondary display.	**Source Mode** • Constant-current source • Constant-current SCAN source • Constant-current RAMP source
5.	Select a digit to change.	With the [◀] or [▶] button
6.	Set current value.	With the [▲] or [▼] button

Settable range

[+00.000 mA] (25 mA range)	-25.000 mA to 25.000 mA

7.	Press the [**OUTPUT**] button to output the set current value.	Verify that OUT is displayed.

8.	Press the [**OUTPUT**] button again to disable output.	Verify that OUT is no longer displayed.

1.4 Pulse Source (PULSE)

- In addition to flow meter calibration, the pulse source can be used for checking and calibrating counters, rotation counters, oscilloscopes, frequency converters and other frequency-input systems.
- Frequency, duty cycle, pulse width and amplitude can be set.

Procedure

1. Set the slide switch.	[**M/S**]
2. Set the function selector.	[**PULSE**]
3. Press the [**SHIFT**] button.	Confirm that SHIFT is displayed.
4. Press the [**MODE**] button to select a parameter for setting.	• Pulse source frequency • Pulse source duty cycle • Pulse source pulse width • Pulse source amplitude
5. Set a value.	With the [▲] or [▼] button

Parameter	Settable Ranges
Frequency (Hz)	0.5, 1, 2, 5, 10, 15, 20, 25, 30, 40, 50, 60, 75, 80, 100, 120, 150, 200, 240, 300, 400, 480, 600, 1200, 1600, 2400, 4800 (Hz)
Duty cycle (%)	As there are 256 settable steps, each step is 0.390625%, which is displayed as 0.39% per step increments. **Example**: If an factory default settings value of 50.00% is incremented by one step, the display shows 50.39%.
Pulse width (ms)	As there are 256 settable steps, the pulse width per step is 1/(256 * frequency).
Amplitude Level	+5 V, ±5 V, +12 V, ±12 V

6.	Press the [**OUTPUT**] button to output the set pulse value.	Verify that OUT is displayed.

7.	Press the [**OUTPUT**] button again to disable output.	Verify that OUT is no longer displayed.

1.5 Using Memory Function (SCAN and RAMP)

SCAN Function	Up to 16 steps of different source values and time intervals can be set.	❖ 1.5.1 "Using the SCAN Function" (p.12)
RAMP Function	A dual slope can be generated to simulate a linear waveform. The number of divisions in each slope can be set.	❖ 1.5.2 "Using the RAMP Function" (p.17)

1.5.1 Using the SCAN Function

Procedure

1. Set the slide switch.	[**M/S**]
2. Set the function selector.	Voltage source: [**CV**] Current source: [**CC**]
3. Press the [**SHIFT**] button.	Confirm that SHIFT is displayed.
4. Press the [**MODE**] button as necessary to select the source mode on the secondary display.	• Voltage source (SCAN±1.5 V or SCAN±15 V) • Current source SCAN±25 mA

During SCAN function setup, SCAN is displayed.

SCAN function factory default settings

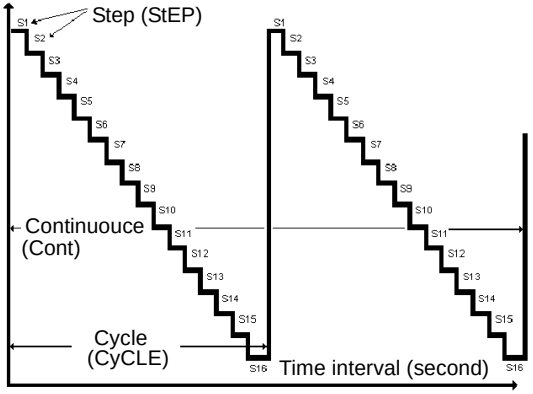
Range	SCAN ±1.5000 V	SCAN ±15.000 V	SCAN ±25.000 mA	Time Interval
Step	Output Value	Output Value	Output Value	
1	+1.5000 V	+15.000 V	+00.000 mA	2 S
2	+1.2000 V	+12.000 V	+04.000 mA	2 S
3	+0.9000 V	+09.000 V	+08.000 mA	2 S
4	+0.6000 V	+06.000 V	+12.000 mA	2 S
5	+0.3000 V	+03.000 V	+16.000 mA	2 S
6	+0.0000 V	+00.000 V	+20.000 mA	2 S
7	-0.3000 V	-03.000 V	+16.000 mA	2 S
8	-0.6000 V	-06.000 V	+12.000 mA	2 S
9	-0.9000 V	-09.000 V	+08.000 mA	2 S
10	-1.2000 V	-12.000 V	+04.000 mA	2 S
11	-1.5000 V	-15.000 V	+00.000 mA	2 S
12	+0.0000 V	+00.000 V	+04.000 mA	0 S
13	+0.0000 V	+00.000 V	+08.000 mA	0 S
14	+0.0000 V	+00.000 V	+12.000 mA	0 S
15	-1.5000 V	-15.000 V	+16.000 mA	0 S
16	+0.0000 V	+00.000 V	+20.000 mA	0 S

Do you want to change the values from the factory default settings?

❖ "Changing Data Settings" (p.16)

5.	Select the SCAN source mode on the secondary display.	With the [◀] or [▶] button

Cont	• Output proceeds sequentially from the first step to the last, then returns to the first step and repeats continuously. • However, if the time interval of the last step is set to 0 seconds, it is ignored, and output continues from the first step. **Example**: When the factory default settings time interval setting for Step 12 is 0 seconds, after output from Step 11, output continues from Step 1.
CyCLE	• Output proceeds sequentially from the first step to the last, then continues output at the settings of the last step. • However, if the time interval of a step is set to 0 seconds, output continues according to the settings of the previous step. **Example**: When the factory default settings time interval setting for Step 12 is 0 seconds, output from Step 11 is maintained continuously.
StEP	Pressing the [▲] or [▼] button moves to the previous or next output step. The value set for each step is output until the next step is selected.



6.	Press the [**OUTPUT**] button to output the set voltage or current value.	Verify that OUT is displayed.

7.	Press the [**OUTPUT**] button again to disable output.	Verify that OUT is no longer displayed.

- Continuous (**CONT**) and Cycle (**CyCLE**) source modes always start at Step 1.
- If the time interval of Step 1 is set to 0s, the source out put is not activated. (Except for STEP source mode)
- When Continuous (**CONT**) and Cycle (**CyCLE**) source modes are stopped by the [**OUTPUT**] button, subsequent source output resumes at Step 1.

Changing Data Settings

1. With the SCAN function active, hold the [**MODE**] button for one second to enter the data setting mode for each source step.

2. Set the time interval and source output value for each step.

Secondary display	Output value
Leftmost two digits of the primary display	Step number
Rightmost two digits of the primary display	Time interval

Press the [**MODE**] button to select the step number, time interval or output value. The parameter digit to be set blinks.

- Press the [▲] or [▼] button to increment or decrement the value, and press the [◀] or [▶] button to move to another digit of the output value.
- Time intervals can be set from 0 to 99 seconds.

3. Press the [**OUTPUT**] button to save your settings.

4. To clear all settings, hold the [▶] button for one second. Time interval and output values are cleared to zero.

5. Hold the [**MODE**] button for one second to exit the step data setting mode.

1.5.2 Using the RAMP Function

Procedure

1. Set the slide switch.	[**M/S**]
2. Set the function selector.	Voltge source: [**CV**] Current source: [**CC**]
3. Press the [**SHIFT**] button.	Confirm that SHIFT is displayed
4. Press the [**MODE**] button as necessary to select the source mode on the secondary display.	• Voltage source (RAMP±1.5 V or RAMP±15 V) • Current source RAMP±25 mA

During RAMP function setup, is displayed.

RAMP function factory default settings

	±1.5000 V		±15.000 V		±25.000 mA	
	Output value	**Number of devision**	**Output value**	**Number of devision**	**Output value**	**Number of devision**
Start	-1.5000 V	015	-15.000 V	015	+25.000 mA	025
End	+1.5000 V	015	+15.000 V	015	-25.000 mA	025

Do you want to change the values from the factory default settings? ❖ "Changing Data Settings" (p.20)

5.	Select the RAMP source mode on the secondary display.	With [◀] or [▶] button

Cont:	After the first slope is output (start to end values), the second slope is output to return to the start value, forming one repeatable cycle. The interval of the first slope = (end output value - start output value) , divisions. **Example**: The initial interval setting with ±1.5000 V range is (1.5 + 1.5) / 15 steps = 0.2 V. The interval of the second slope = (starting output value - end output value) / divisions.
CyCLE:	After the first slope is output (start to end values), the starting value of the second slope is output, continuing output according to the settings.

6.	Press the [**OUTPUT**] button to output the set voltage or current value.	Verify that OUT is displayed.

The output value changes according to settings every 0.33 seconds.

7.	Press the [**OUTPUT**] button again to disable output.	Verify that OUT is no longer displayed.

Changing Data Settings

1. With the RAMP function active, hold the [**MODE**] button for one second to enter the data setting mode for each source step.

2. The RAMP function involves dual slope generation.

- Set the number of divisions from the start to the end position, and from the end to the start position.
- Also set the output values of the start and end positions.

Secondary display	Output value
Leftmost digit of primary display	Start [**S**] or End [**E**] position
Rightmost three digits of primary display	Number of divisions

3. Press the [▲] or [▼] button to select the start position [**S**] or end position [**E**]. Then press the [**MODE**] button to switch between the number of divisions and output value. The parameter digit to be set blinks.

- Press the [▲] or [▼] button to increment or decrement the value, and press the [◀] or [▶] button to move to another digit to set.
- The number of divisions can be set from 1 to 999.

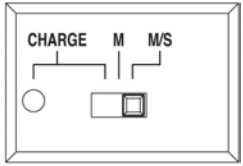
4. Press the [**OUTPUT**] button to save your settings.

5. Hold the [**MODE**] button for one second to exit the step data setting mode.

Measurement Function Chapter 2

2.1 Basic Measurement Procedure (Common Procedure)

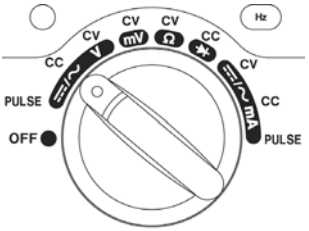
1. Set the slide switch to the[**M**] or [**M/S**] position.



- Setting [**M**] is for measurement only.
- Setting [**M/S**] is for measuring and sourcing at the same time.

2. Set the function selector to the following position.

(ex. Measuring voltage)



Measuring voltage	[⎓ / ∿ **V**] or [**mV**]*
Measuring current	[⎓ / ∿ **mA**]
Measuring frequency	Voltage: [⎓ / ∿ **V**] or [**mV**] Current: [⎓ / ∿ **mA**]
Measuring resistance	[Ω]
Measuring diode	[⊣◁]
Measuring temperature	[**mV**]

* Setting [**mV**] is for 50 mV and 500 mV range measurement.
Setting [⎓ / ∿ **V**] is for the range over 500 mV measurement.

3. Connect the test leads to the INPUT terminals.

Red*: (+) INPUT terminal
Black*: (-) INPUT terminal
*Serves as a temperature probe during temperature measurement

The steps up to here are common to all functions. Follow the appropriate separate procedure from here.

2.2 Measuring Voltage

Procedure

1.	Set the slide switch.	[**M**] or [**M/S**]

2.	Set the function selector.	[⎓/∿**V**] or [**mV**]

3.	Connect the test leads to the terminals.	Red : (+) INPUT terminal Black: (-) INPUT terminal

4.	Press the [**AC/DC**] button as needed to select the appropriate voltage measurement function.

5.	To enable manual range selection, press the [**RANGE/AUTO**] button.	The AUTO indicator is not displayed on the LCD.

To re-enable auto-ranging, hold the [**RANGE/AUTO**] button for one second.

6.	Connect the test leads to the circuit to be measured, and read the displayed value.

- Press the [**DUAL**] button to activate the Dual Display mode.
- Press the [**Hz**] button to activate frequency measurement (or duty cycle or pulse width) in the Dual Display mode.

❖ Details→ 3.5 "Dual Display Function" (p.41)

2.3 Measuring Current

Procedure

1.	Set the slide switch.	[**M**] or [**M/S**]

2.	Set the function selector.	[⎓/∿**mA**]

3.	Connect the test leads to the terminals.	Red : (+) INPUT terminal Black: (-) INPUT terminal

4.	Press the [**AC/DC**] button as needed to select the appropriate current measurement function.

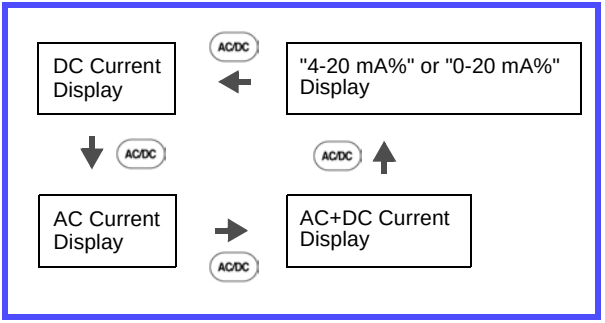
5.	To enable manual range selection, press the [**RANGE/AUTO**] button	The AUTO indicator is not displayed on the LCD.

To re-enable auto-ranging, hold the [**RANGE/AUTO**] button for one second.

6.	Connect the test leads to the circuit to be measured, and read the displayed value.

- Press the [**DUAL**] button to activate the Dual Display mode.
- Press the [**Hz**] button to activate frequency measurement (or duty cycle or pulse width) in the Dual Display mode.

❖ Details→ 3.5 "Dual Display Function" (p.41)



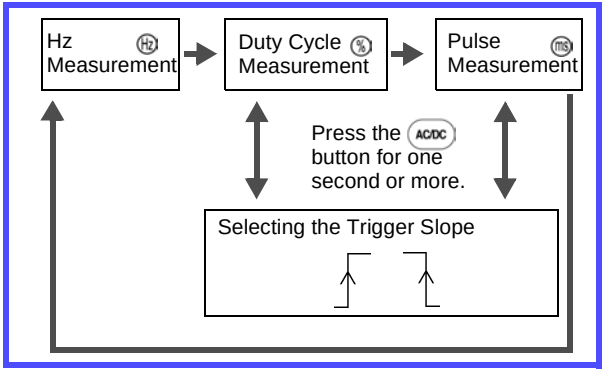
2.4 Measuring Frequency

Procedure

1. Display voltage or current.	2.2 "Measuring Voltage" (p.23) or procedure 1. to 4. of 2.2 "Measuring Voltage" (p.23).

2. Press the [**Hz**] button and read the displayed voltage.

3. Hold the [**Hz**] button repeatedly toggles through Hz, duty cycle and pulse measurement.



4. Hold the [**Hz**] button for one second to return to the status in Step 1.

2.5 Measuring the Resistance

Procedure

1.	Set the slide switch.	[**M**] or [**M/S**]

2.	Set the function selector.	[Ω]

3.	Connect the test leads to the terminals.	Red : (+) INPUT terminal Black: (-) INPUT terminal

4.	Connect the test leads to the circuit to be measured, and read the displayed value.

5.	To enable manual range selection, press the [**RANGE/AUTO**] button.	The AUTO indicator is not displayed on the LCD.

To re-enable auto-ranging, hold the [**RANGE/AUTO**] button for one second.

6.	Pressing the [**AC/DC**] button toggles the continuity test function on and off. At this time, auto-ranging is disabled.	The •)) mark is displayed/not displayed.

2.5.1 Continuity Test

Procedure

1.	When the resistance measuring function is active, pressing the [**AC/DC**] button enables the continuity test function using resistance measurement.	The •)) mark is displayed.

At this point, the 500 Ω range is selected, and if auto-ranging was active, it is disabled and manual ranging is enabled.

- Pressing the [**RANGE**] button selects each range.
- The beeper sounds whenever the resistance is 1000 counts or less in the selected range.

2.	Press the [**AC/DC**] button again to exit the continuity testing function.

2.6 Diode Test

Procedure

1.	Set the slide switch.	[**M**] or [**M/S**]

2.	Set the function selector.	[⊣◀]

3.	Connect the test leads to the terminals.	Red : (+) INPUT terminal Black: (-) INPUT terminal

4.	Connect the test leads to the circuit to be measured. The display appears as follows:

Forward direction	0.3 to 0.8 V forward voltage drop displayed
Reverse direction	[**OL**] displayed.
Short-circuit	Approx. 0 V displayed, and beeper sounds
Open-circuit	[**OL**] displayed in forward direction

2.7 Measuring Temperature

Temperature can be measured using an optional temperature probe.

Procedure

1.	Set the slide switch.	[**M**] or [**M/S**]

2.	Set the function selector.	[**mV**]

3.	Connect the temperature probe to the terminals	(+) INPUT terminal (-) INPUT terminal

4.	Hold the [**TEMP**] button for one second to start temperature measurement.

Special Measurement Functions Chapter 3

This instrument provides the following special measurement functions:

3.1 Recording Function

During measurement, maximum (MAX), minimum (MIN) and average (AVG) values can be automatically recorded in memory.

In what situations is it used? For acquiring long-term data and checking for transients.

Procedure

1.	While measuring, hold the [**HOLD/MAX MIN**] button for one second.	The MAX AVG MIN indicators appear on the display as the recording function starts.

2. Press the [**HOLD/MAX MIN**] button to change the display as follows:

Display indication	Real-time measurement value
MAX AVG MIN	Current measurement value
MAX	Maximum value
MIN	Minimum value
AVG	Average value

3.	Hold the [**HOLD/MAX MIN**] button again for one second to stop the recording function.	The MAX AVG MIN indicators disappear from the display.

- The beeper sounds and the relevant value is refreshed when a new maximum or minimum value is recorded.
- When an overload value is measured, calculation of the average value stops, and [**OL**] is displayed for the average value.
- When the recording function is started with auto-ranging enabled, the maximum (MAX), minimum (MIN) and average (AVG) values can be in different ranges.

3.2 Data Hold / Refresh Hold Function

In what situations is it used? Use to simplify reading fluctuating measurements.

Data Hold Function

This function holds measured values on the display.

Procedure

1.	Press the [**HOLD/MAX MIN**] button to activate the Data Hold function.	DH appears on the display, and the displayed value is held (retained).

2.	Press the [**HOLD/MAX MIN**] button again to measure one time and hold the measurement data.

3.	Press the [**HOLD/MAX MIN**] button for one second to cancel the Data Hold function.	DH disappears from the display.

Refresh Hold Function

- This function automatically refreshes the (held) displayed value when the measured value changes while Data Hold is active.
- The Data Hold function can be changed to the Refresh Hold function in the Power-On Options.

❖ 7016 instruction manual 5.4 Power-On Options

Procedure

1.	Press the [**HOLD/MAX MIN**] button to activate the Refresh Hold function.	DH appears on the display.

2.	Press the [**HOLD/MAX MIN**] button for one second to cancel the Refresh Hold function.	DH disappears from the display.

3.3 Relative (relative display) Function

The function applies to all measurement functions, subtracting a reference value from the measured value and displaying the calculated result.

In what situations is it used?

- When you want to zero out the internal resistance of probes
- When you want to read only the difference (offset) of a measured value from another value
- When you want high-accuracy measurement in the 50 mV DC or DCA ranges

Procedure

1.	Press the [**REL**] button to activate the Relative function.	△ appears on the display.

At this point,
- The displayed value becomes the reference for subsequent measurements, and is redisplayed as zero.
- If measured data is at overload level, [OL] appears on the display.

2.	Press the [**REL**] button again to cancel the Relative function.	△ disappears from the display

3.4 1-ms Peak Hold Function

- Works with voltage and current measurement functions
- Shows the peak value of an input signal waveform

In what situations is it used?

Use to determine the crest factor of a waveform, where *crest factor = waveform peak value / true rms value*

Procedure

1.	Hold the [**AC/DC**] button for one second to activate the 1-ms Peak Hold function.	DH MAX appears on the display.

At this point,
- The measurement displayed when the function was activated is held (retained).
- If auto-ranging was enabled, manual ranging is activated with the currently operative range retained.

- Pressing the [**HOLD/MAX MIN**] button updates the displayed (held) MAX and MIN values.

Display indication	Measurement value
DH MAX	Maximum value
DH MIN	Minimum value

- The beeper sounds when a new maximum or minimum value is measured.
- Pressing the [**DUAL**] button resets the MAX and MIN values and restarts 1-ms Peak Hold operation.
  The maximum (MAX) and minimum (MIN) display mode are not changed.

2.	Press the [**AC/DC**] button for one second to cancel the 1-ms Peak Hold function.	DH MAX disappears from the display.

3.5 Dual Display Function

This function simultaneously monitors two different measurement parameters (voltage, current, frequency, duty cycle or pulse width) of one signal.

Procedure

1. Press the [**DUAL**] or [**Hz**] button to activate dual display.

(1) Pressing the [**DUAL**] button selects the Dual Display mode
Pressing it repeatedly changes the display as follows.

Function Selector Position	Primary Display	Secondary Display
⎓/∿V	Voltage (V) measurement	Frequency measurement
		Source function display
mV	Voltage (mV) measurement	Frequency measurement
		Source function display
mA	Current (mA) measurement	Frequency measurement
		Source function display

(2) Press the [**Hz**] button to activate frequency measurement (or duty cycle or pulse width) in the Dual Display mode.
Pressing it repeatedly changes the display as follows.

Function Selector Position	Primary Display	Secondary Display
⎓/∿ V	Frequency	Voltage (V) measurement
	Duty cycle	
	Pulse width	
mV	Frequency	Voltage (mV) measurement
	Duty cycle	
	Pulse width	
mA	Frequency	Current (mA) measurement
	Duty cycle	
	Pulse width	

- When measuring frequency or pulse width, pressing the [**RANGE/AUTO**] button toggles between auto- and manual ranging.
- When measuring duty cycle or pulse width, holding the [**AC/DC**] button for one second toggles the trigger slope between  and  .

2. To cancel the Dual Display mode

- When pressed [**DUAL**] button at procedure 1. : Press [**DUAL**] button again.
- When pressed [**Hz**] button at procedure 1. : Hold the [**Hz**] button for one second.

HIOKI

HIOKI E. E. CORPORATION

HEAD OFFICE
81 Koizumi, Ueda, Nagano 386-1192, Japan
TEL +81-268-28-0562 FAX +81-268-28-0568
E-mail: os-com@hioki.co.jp URL http://www.hioki.com/
(International Sales and Marketing Department)

HIOKI USA CORPORATION
6 Corporate Drive, Cranbury, NJ 08512, USA
TEL +1-609-409-9109 FAX +1-609-409-9108

Edited and published by Hioki E.E. Corporation
Technical Support Section

Printed on recycled paper Printed in Japan