

Keysight B2980B Series Femto/Picoammeter Electrometer/High Resistance Meter

B2981B/B2983B
B2985B/B2987B

Quick Reference



Preparing the Instrument for Use

To position the instrument:

1. Grab the handle by the sides and pull outward.
2. Rotate the handle.
3. Position the instrument.

To turn the instrument ON:

1. Connect a three-conductor power cord from AC input connector to an AC power outlet at your site.
2. Press the line switch.

For B2983B and B2987B, if the power cord is removed from the instrument and the built-in battery is used for operation, connect the instrument chassis to an electrical ground through the Earth (ground) terminal, for safety.

To set the power line cycle:

This instrument can automatically detect the AC power line frequency when it is turned on. When the instrument is shipped from the factory, this function is enabled. The boot up screen will show Power Line Frequency: AUTO. If the setting is not changed, you do not need to set the power line frequency.

Low Terminal State of Voltage Source, Circuit Common and Floating (for B2985B/B2987B):

With the default setting, Voltage Source Low terminal is connected to the circuit common. However, it can be internally disconnected from the common for making the floating condition. This setup is used for changing the earthing point. To make the floating condition, set the Low Terminal State parameter to FLOATING (default: CCOM) on the Output Connection dialog box opened by pressing the System Menu > Config > Source > Connection function keys.

WARNING (for B2985B/B2987B):

When the Low terminal is connected to the circuit common, the Common terminal has same potential as the Low terminal. If the Common terminal is not connected to the earth (ground) terminal (for floating measurement) in this state, potentially hazardous voltage of up to ± 500 V may be applied to the Common terminal. To prevent electrical shock, do not touch any of measurement circuit at any time while a floating measurement is in progress. Also use accessories that comply with IEC 61010-031. All terminals and the extended conductors must be isolated by using insulation caps, sleeves, etc.

Latest Information

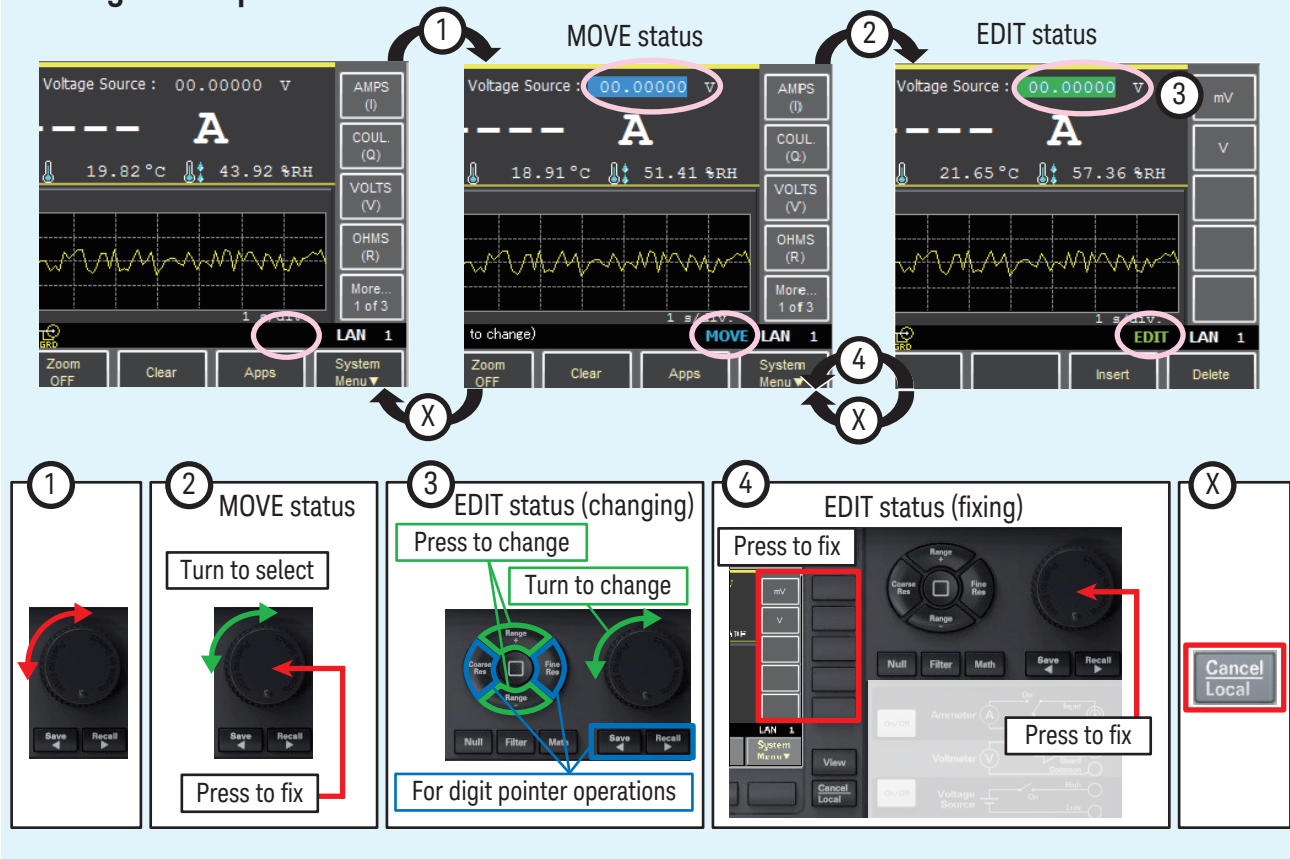
To get the latest firmware, software, manuals, and support information, go to www.keysight.com. You can then search them by product number.



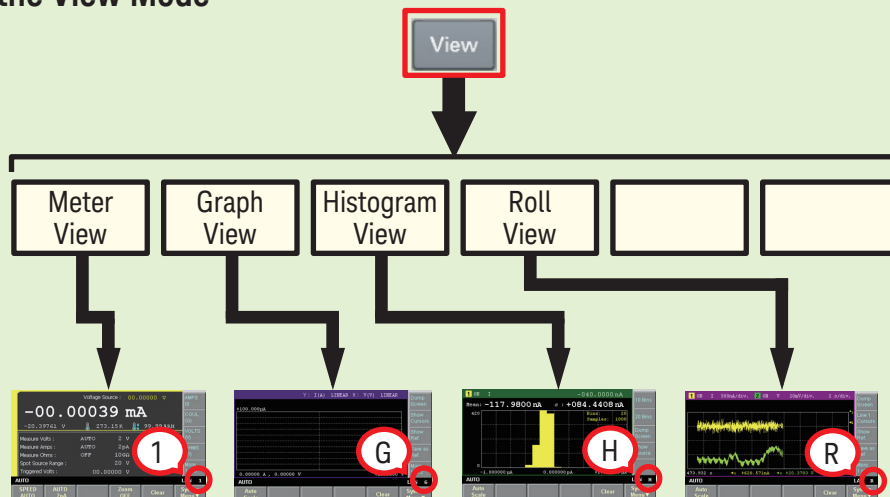
1. Line switch: Turns the instrument on or off.
2. USB-A connector: Used to connect a USB memory.
3. Run/Stop key: Starts or stops a repeat (continuous) measurement.
4. Single key: Starts a single (one shot) measurement or initiates trigger system.
5. Assist keys: Five keys which assist you in changing the measurement setup.
6. Battery charge level indicator (for B2983B/B2987B): Indicates charge level of the built-in Lithium-ion rechargeable battery.
7. Measurement navigation keys: Used to change SPEED and RANGE settings. The following keys are available.
Coarse Res: Increases measurement speed (decreases aperture time).
Fine Res: Decreases measurement speed (increases aperture time).
Range +: Changes measurement range up.
Range -: Changes measurement range down.
[home]: Sets AUTO range and Normal auto aperture.
8. Null key: Enables or disables the internal zero correction and null (offset cancel) functions.
Filter key: Enables or disables the measurement filter function.
Math key: Enables or disables the math function.
9. Rotary knob
MOVE (blue) status: Turning the knob moves the pointer, and pressing the knob fixes the pointer position.
EDIT (green) status: Turning the knob changes the value of the setup parameter, and pressing the knob fixes the value.
10. Save and Recall keys: Used to save/recall all setup information of the instrument.
If the field pointer is in the EDIT (green) status on an alpha/numeric value entry field such as Voltage Source and File Name, the keys work to change the field pointer to the digit pointer. With the digit pointer, the keys work to move it.
11. Ammeter On/Off switch: Enables or disables Ammeter. Turn on for the current, charge, or resistance measurement.
- 12.*Voltage Source On/Off switch: Enables or disables Voltage Source. It turns red in the high voltage state over ± 21 V.
13. View key: Changes the view mode.
14. Cancel/Local key: Cancels the setup operation if the instrument is in the local state.
Returns the instrument to the local state if it is in the remote control state.
15. Function keys: Six keys which are used for setting up the various detailed functions.
16. Ammeter input connector: Triaxial connector for the current, charge, or resistance measurement.
Analog Out terminal: Banana terminal for analog output.
This terminal outputs the voltage proportional to the present measurement result. Max. ± 2 V
Common terminal: Banana terminal for circuit common. This is the Common for Ammeter, Voltmeter, and Analog Out.
- 17.*Voltmeter input connector: Triaxial connector for the voltage measurement.
*Voltage Source output terminals: Banana terminals (High and Low) for DC voltage output up to ± 1000 V.
18. Earth (ground) terminal: Terminal connected to earth (ground) through the power cord. This terminal is also connected to the frame (chassis) of this instrument.
19. Digital I/O connector: D-sub 9 pin female connector for general purpose I/O (GPIO). Can be used as an interface to a handler or the likes.
- 20.*Interlock connector: Connector for the interlock function. If the terminals are open, the output voltage is limited to ± 21 V.
- 21.*Humidity connector: Connector for humidity sensor used for the relative humidity measurement.
22. AC input connector: Three-conductor AC power cord is connected to this receptacle.
- 23.*Thermocouple connector: Connector for Type K thermocouple used for the temperature measurement.
24. GPIB interface connector: Connects to GPIB interface on an external computer or equipment.
25. USB-B connector: Connects to USB interface.
26. LAN interface connector: Connects to 10/100 Base-T interface.
27. Trigger In and Trigger Out connectors: BNC connectors for trigger input and out. Used to perform the operation synchronized with an external equipment.

* Only for B2985B/B2987B.

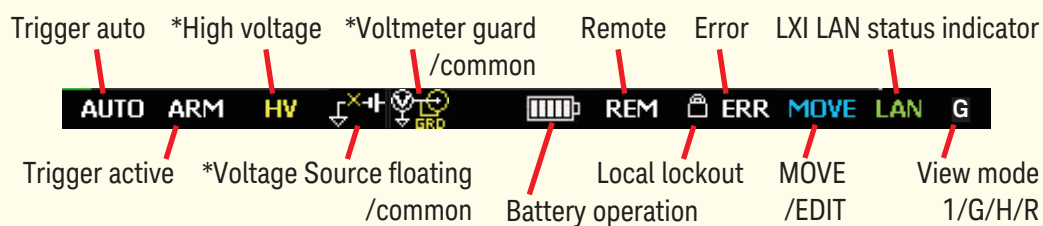
Editing the Setup



Changing the View Mode



Status Information



* Only for B2985B/B2987B.

Performing Current Measurement

You can perform the current measurement as follows.

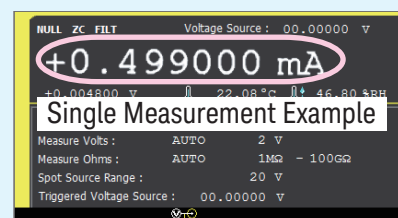
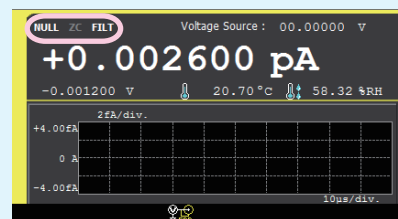
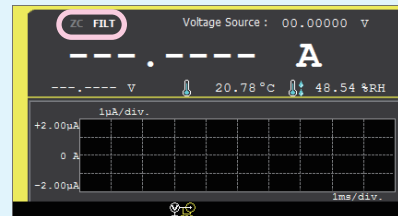
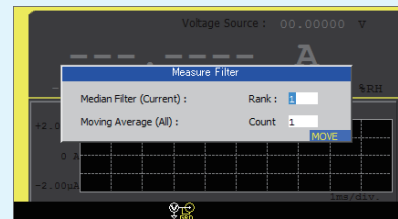
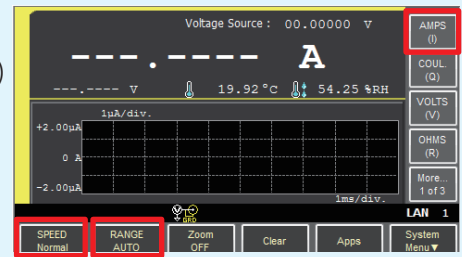
1. Press **View** key and **Meter View** key to display the Meter view.
2. Press **AMPS (I)** key to set the current measurement mode. (for B2985B/B2987B)
3. Use **Range** **+** **Range** **-** keys or **RANGE AUTO** key to set the measurement range you want to use.
4. Use **Coarse Res** **+** **Fine Res** keys or **SPEED Normal** key to set the measurement speed (aperture time) you desire.
5. Press **Filter** key to open the Measure Filter dialog box.
And set the measurement filter on the dialog box.
6. Enable the internal zero correction function.
 - a. Turn the Ammeter **On/Off** switch off.
 - b. Press **Null** key.
This measures the instrument internal offset current and turns the ZC indicator on (gray).
7. Press the Ammeter **On/Off** switch to enable Ammeter.
This turns the switch green. **On/Off**
8. Enable the null (offset cancel) function.
 - a. Make measurement terminal connections you desire for getting the offset value.
 - b. Press **Run/Stop** key to start a repeat (continuous) measurement.
And confirm that the measurement value is enough less than the value you want to measure. If the value is noisy, adjust setting of the measurement speed (aperture time) and the measurement filter.
 - c. Press **Run/Stop** key to stop the measurement.
 - d. Press **Null** key. This measures the offset value and turns the NULL indicator on.
9. Connect measurement current.
10. Press **Single** key to start a single (one shot) measurement, or press **Run/Stop** key to start a repeat (continuous) measurement.

The displayed measurement value will be the actual measurement value minus the offset value.

If the measurement range change does not occur during the measurement, the zero correction is performed and the ZC indicator is turned on (white). If the range change occurs, the zero correction is not performed and the ZC indicator is turned on (gray).

11. Press **Run/Stop** key to stop the repeat measurement if necessary.

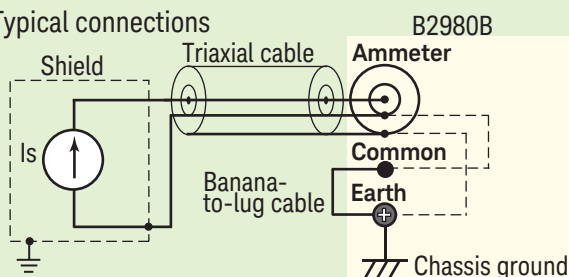
12. Press the Ammeter **On/Off** switch to disable Ammeter. This turns off the switch light. **On/Off**



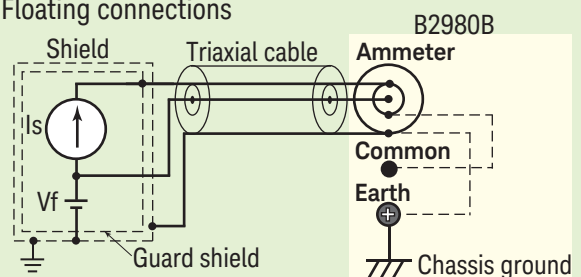
Single Measurement Example

Connections for Current Measurement

a) Typical connections



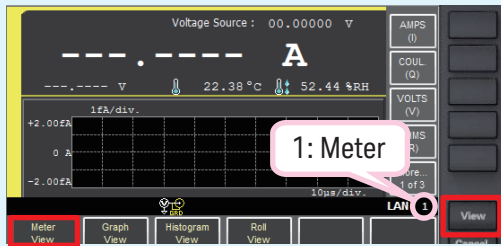
b) Floating connections



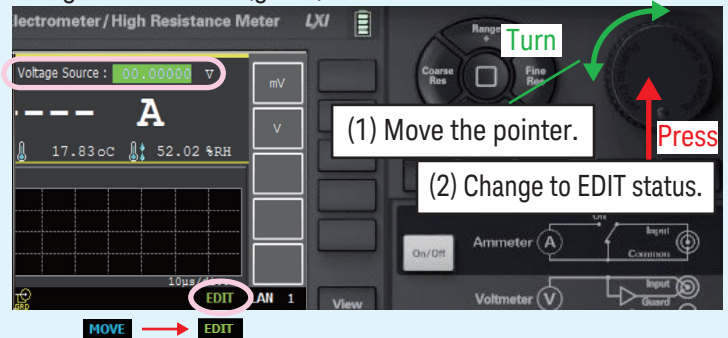
Applying DC Voltage (for B2985B/B2987B)

You can apply a constant voltage of +500 mV from the voltage source by the following procedure.

1. Press **View** key and **Meter View** key to display the Meter view.



2. Use the rotary knob to select the Voltage Source field and change it to the EDIT (green) status.

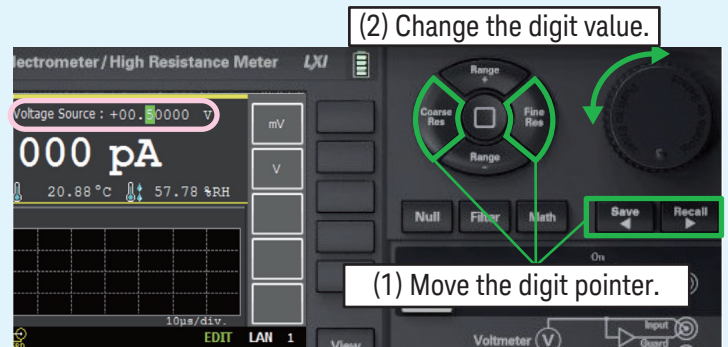


3. Set the Voltage Source value using the following step a or b.

- a. Turn the rotary knob to set the Voltage Source value to +0.5 V.



- b. Press the Coarse Res, Fine Res, Save, or Recall key to move the digit pointer to one digit after the decimal point. And then, turn the rotary knob to set the Voltage Source value to +0.5 V.



4. Press an assist key or the rotary knob to fix the setting value. The field pointer changes to the MOVE (blue) status.

5. Press the Voltage Source **On/Off** switch to enable the output. This turns the switch green. And the voltage source starts output.

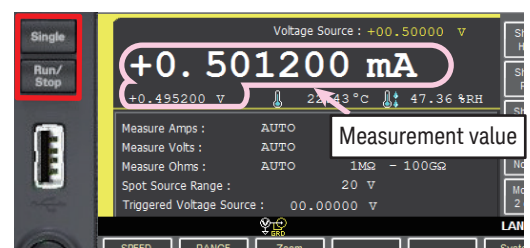


Performing Measurement

- Press **Single** key to start a single measurement.
 Press **Run/Stop** key to start a repeat measurement.
 To change the measurement parameter, use AMPS (I), COUL (Q), VOLTS (V), or OHMS (R) assist key.

Stopping DC Output

- Press the Voltage Source **On/Off** switch to disable the output.
 This turns off the switch light.



1 kΩ resistor measurement example

Meter View

1. Latest measurement data

D1. Measurement data.

D2. For the limit test, D2 displays PASS or FAIL.

2. NULL (Offset Cancel), ZC (Zero Correction), FILT (Filter), and MATH (Math) indicators.

3. SPEED: Sets the setting mode (aperture mode) of the measurement speed to auto or manual.

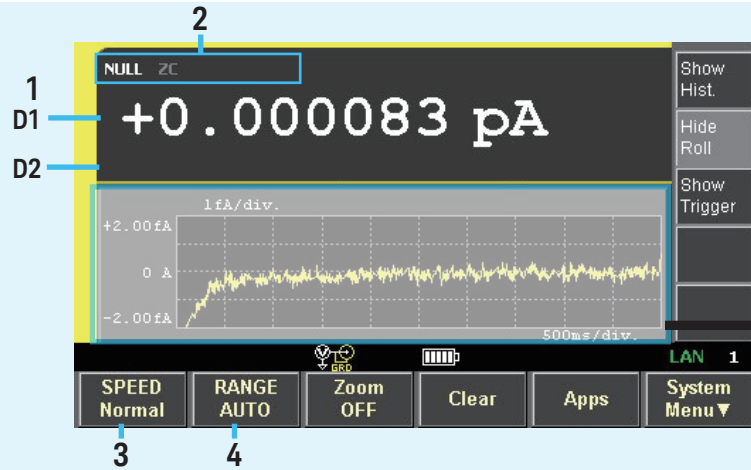
The softkey displays the present setting.

Use the measurement navigation keys (Coarse Res and Fine Res) to change the aperture time.

4. RANGE: Sets the measurement range mode to AUTO or FIXED.

If it is set to AUTO, the softkey displays AUTO. If it is set to FIXED, the softkey displays the present range value.

Use the measurement navigation keys (Range+ and Range-) to change the range.



Range setup sub-panel

Measure Amps : FIXED 20mA

Measure Amps

Current measurement range

Trigger setup sub-panel

Trigger : MANUAL
Count : 1
Delay : 0.000 s
Period : 10.00 μ s
Trigger : AUTO

Trigger

Trigger type: AUTO, SYNC, TIMER, MANUAL

Count

Trigger count (number of triggers)

Delay

Trigger delay time

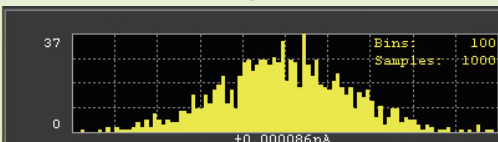
Period

Trigger period

Trigger

Trigger source: AUTO, BUS, TIMER, INT1, INT2, LAN, EXTn (n=1 to 7), TIN

Condensed histogram



Condensed roll graph



Graph View

Displays the graph for plotting the measurement or math result.

1. Y-axis data type: I (A) or MATH.

2. Y-axis scale: LINEAR or LOG.

3. X-axis data type: I (A), MATH, or t (s).

4. X-axis scale: LINEAR or LOG.

5. Graph maximum value

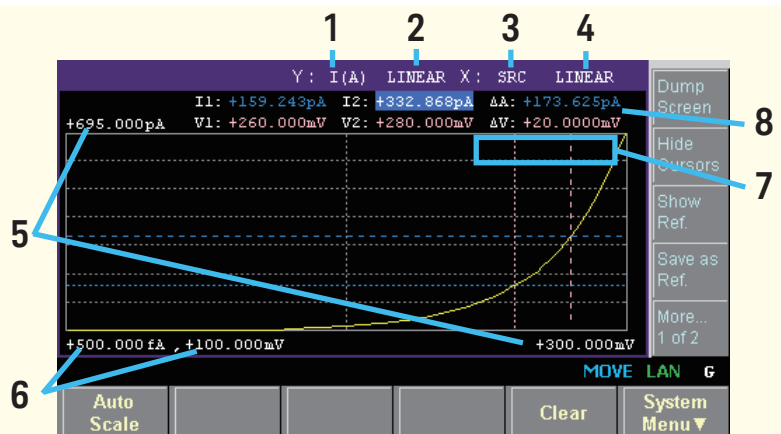
6. Graph minimum value

7. Y-axis data at the active X-cursor position. ---- is displayed for the no-data position.

8. Cursor data (controlled by the Show Cursors or Hide Cursors assist key)

First line: Positions and distance (e.g. I1, I2, Δ A) of Y-cursors 1 and 2

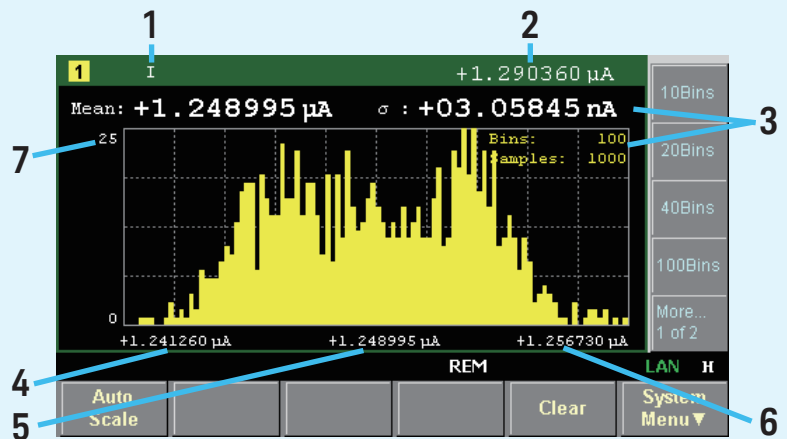
Second line: Positions and distance (e.g. t1, t2, Δ t) of X-cursors 1 and 2



Histogram View

Displays the histogram to show the number of occurrences of the measurement data corresponding to the defined range (bin).

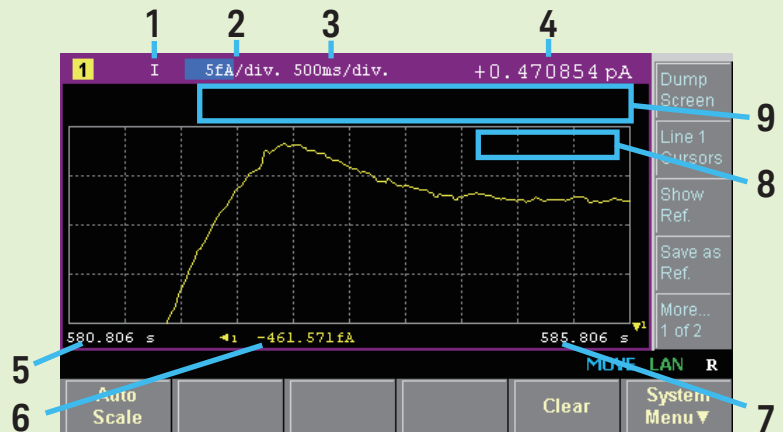
1. X-axis data type: I, Q, V, or R.
2. Latest measurement data
3. Statistical data (Mean: mean value, σ : standard deviation, Bins: number of bins, Samples: number of sample data)
4. X-axis value for minimum bin
5. X-axis value for central bin
6. X-axis value for maximum bin
7. Y-axis maximum value. You can set this using the rotary knob.



Roll View

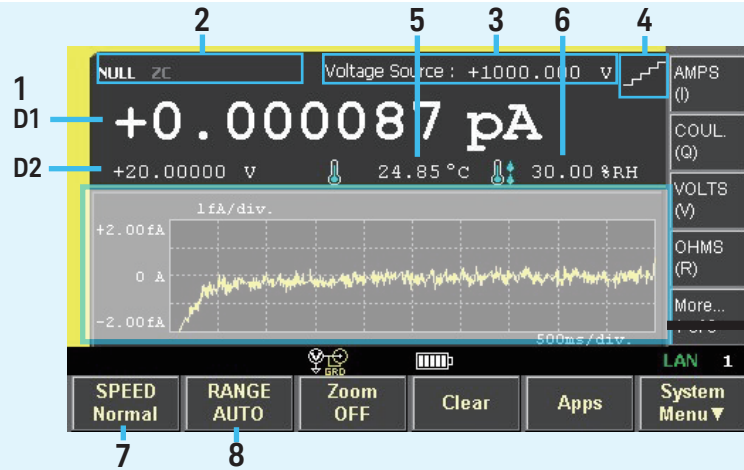
Displays the time domain graph for plotting the measurement data.

1. Y-axis data type: I, Q, V, or R.
2. Y-axis scale per division: A/div., C/div., V/div., or Ω /div..
3. X-axis scale per division: s/div.
4. Latest measurement data
5. X-axis minimum value (minimum timestamp)
6. Y-axis offset values for line 1
7. X-axis maximum value (maximum timestamp)
8. Y-axis data at the active X-cursor position. ----- is displayed for the no-data position.
9. Cursor data (controlled by the Line 1 Cursors or Hide Cursors assist key)
 - First line: Positions and distance (e.g. I1, I2, ΔA) of Y-cursors 1 and 2
 - Second line: Positions and distance (e.g. t1, t2, Δt) of X-cursors 1 and 2



Meter View

- Latest measurement data
D1. Primary measurement data.
D2. Secondary measurement data.
For the limit test, D2 displays PASS or FAIL.
- NULL (Offset Cancel), ZC (Zero Correction), FILT (Filter), MATH (Math), and OC (Over Current) indicators.
- Voltage Source: Output voltage of the voltage source
- Source shape indicator. DC, staircase sweep, list sweep, or square wave. DC does not show the indicator.
- Temperature measurement data if the thermocouple or humidity sensor is connected.
You can change the temperature unit to °C (Celsius), °F (Fahrenheit), or K (Kelvin).
- Humidity measurement data if the humidity sensor is connected.
- SPEED: Sets the setting mode (aperture mode) of the measurement speed to auto or manual.
The softkey displays the present setting.
Use the measurement navigation keys (Coarse Res and Fine Res) to change the aperture time.
- RANGE: Sets the measurement range mode to AUTO or FIXED.
If it is set to AUTO, the softkey displays AUTO. If it is set to FIXED, the softkey displays the present range value.
Use the measurement navigation keys (Range+ and Range-) to change the range.
It is applied to the latest selected measurement mode (AMPS(I), COUL(Q), VOLTS(V), or OHMS(R)).



Range setup sub-panel

Measure Amps : AUTO 2 pA
Measure Volts : AUTO 2 V
Measure Ohms : AUTO 1 MΩ - 100 GΩ
Spot Source Range : 20 V
Triggered Voltage Source : 00.00000 V

Measure Amps
Measure Coulomb
Measure Volts
Measure Ohms
Spot Source Range
Triggered Voltage Source

Current measurement range
Charge measurement range
Voltage measurement range
Resistance measurement range
DC voltage output range
Output voltage level, to be forced by receiving the trigger signal.

Source function sub-panel

VS Function : LINEAR SINGLE
Start : 00.00000 V Stop : 00.00000 V
Points : 1 Step : 00.00000 V

VS Function

Sweep mode: LINEAR SINGLE, LINEAR DOUBLE, LIST, ARB SQUARE, OFF
Sweep start value
Sweep stop value
Number of sweep steps
Sweep step value

Trigger setup sub-panel

Trigger : MANUAL

	Measure	Source
Count :	1	1
Delay :	0.000 s	0.000 s
Period :	10.00 μs	10.00 μs
Trigger :	AUTO	AUTO

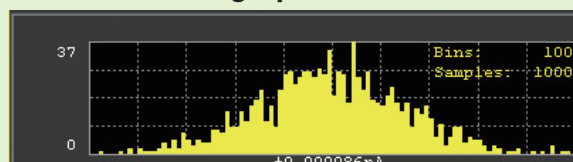
Trigger

Trigger type: AUTO, SYNC, TIMER, MANUAL
Trigger count (number of triggers)
Trigger delay time
Trigger period
Trigger source: AUTO, BUS, TIMER, INT1, INT2, LAN, EXTn (n=1 to 7), TIN

Condensed histogram

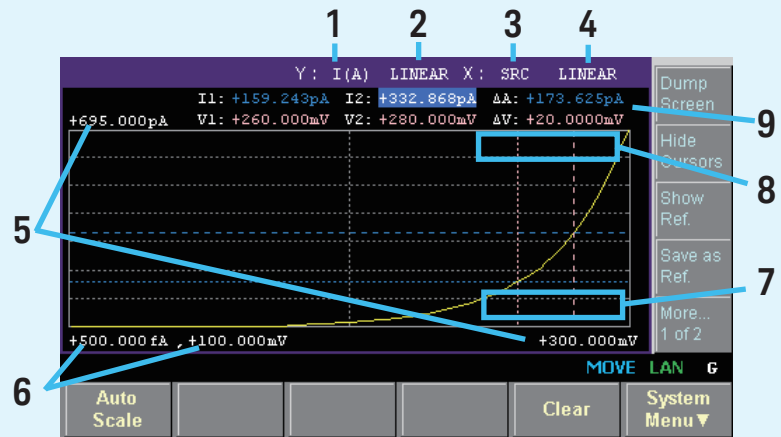


Condensed roll graph



Graph View

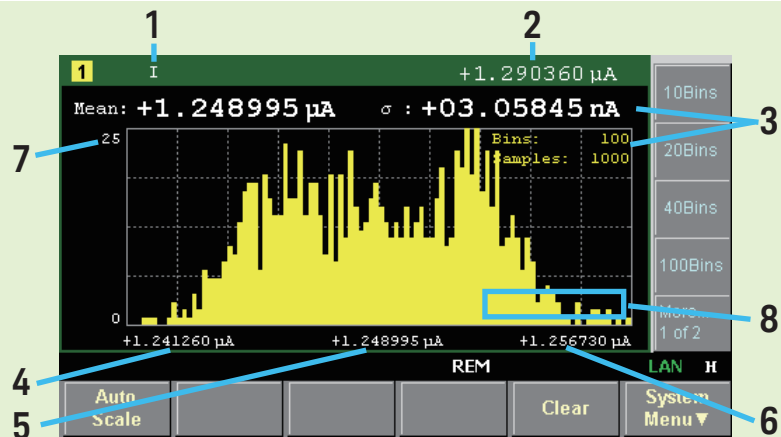
Displays the graph for plotting the measurement or math result.



1. Y-axis data type: I (A), Q(C), V (V), R (Ω), or MATH.
2. Y-axis scale: LINEAR or LOG.
3. X-axis data type: I (A), Q(C), V (V), R (Ω), MATH, SRC or t (s).
4. X-axis scale: LINEAR or LOG.
5. Graph maximum value
6. Graph minimum value
7. Output voltage value of the voltage source (controlled by the Show Source or Hide Source assist key).
If the Voltage Source On/Off switch is turned on, the output value is displayed in yellow.
You can change the output voltage using this field.
8. Y-axis data at the active X-cursor position. ----.---- is displayed for the no-data position.
9. Cursor data (controlled by the Show Cursors or Hide Cursors assist key)
First line: Positions and distance (e.g. I1, I2, ΔA) of Y-cursors 1 and 2
Second line: Positions and distance (e.g. t1, t2, Δt) of X-cursors 1 and 2

Histogram View

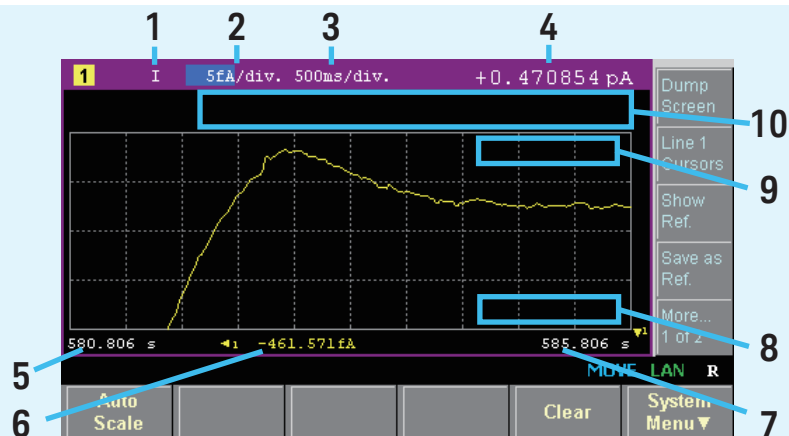
Displays the histogram to show the number of occurrences of the measurement data corresponding to the defined range (bin).



1. X-axis data type: I, Q, V, or R.
2. Latest measurement data
3. Statistical data (Mean: mean value, σ : standard deviation, Bins: number of bins, Samples: number of sample data)
4. X-axis value for minimum bin
5. X-axis value for central bin
6. X-axis value for maximum bin
7. Y-axis maximum value. You can set this using the rotary knob.
8. Output voltage value of the voltage source (controlled by the Show Source or Hide Source assist key).
If the Voltage Source On/Off switch is turned on, the output value is displayed in yellow.
You can change the output voltage using this field.

Roll View

Displays the time domain graph for plotting the measurement data.



1. Y-axis data type: I, Q, V, or R.
2. Y-axis scale per division: A/div., C/div., V/div., or Ω /div..
3. X-axis scale per division: s/div.
4. Latest measurement data
5. X-axis minimum value (minimum timestamp)
6. Y-axis offset values for line 1
7. X-axis maximum value (maximum timestamp)
8. Output voltage value of the voltage source (controlled by the Show Source or Hide Source assist key).
If the Voltage Source On/Off switch is turned on, the output value is displayed in yellow.
You can change the output voltage using this field.
9. Y-axis data at the active X-cursor position. ----.---- is displayed for the no-data position.
10. Cursor data (controlled by the Line 1 Cursors or Hide Cursors assist key)
First line: Positions and distance (e.g. I1, I2, ΔA) of Y-cursors 1 and 2
Second line: Positions and distance (e.g. t1, t2, Δt) of X-cursors 1 and 2