TEXIO

Test and Measurement Solutions

INSTRUCTION MANUAL

DIGITAL MULTIMETER

DL-2052

■ About Brands and Trademarks

"TEXIO" is the product brand name of our industrial electronic devices.

All company names and product names mentioned in this manual are the trademark or the registered trademark of each company or group in each country and region.

■ About the Instruction Manual

 Be aware that the product specifications and the contents of this manual are subject to change for the purpose of improvement.

CONTENTS

USING THE PRODUCT SAFELY

■ Preface

To use the product safely, read instruction manual to the end.
Before using this product, understand how to correctly use it.
If you read the manuals but you do not understand how to use it, ask us or your local dealer.
After you read the manuals, save it so that you can read it anytime as required.

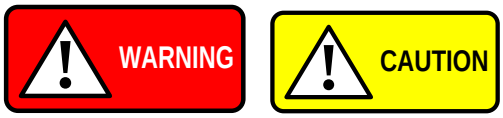
■ Pictorial indication

The manuals and product show the warning and caution items required to safely use the product.
The following pictorial indication is provided.

<Pictorial indication>	
	Some part of this product or the manuals may show this pictorial indication. In this case, if the product is incorrectly used in that part, a serious danger may be brought about on the user's body or the product. To use the part with this pictorial indication, be sure to refer to the manuals.
	If you use the product, ignoring this indication, you may get killed or seriously injured. This indication shows that the warning item to avoid the danger is provided.
	If you incorrectly use the product, ignoring this indication, you may get slightly injured or the product may be damaged. This indication shows that the caution item to avoid the danger is provided.

Please be informed that we are not responsible for any damages to the user or to the third person, arising from malfunctions or other failures due to wrong use of the product or incorrect operation, except such responsibility for damages as required by law.

USING THE PRODUCT SAFELY



■ Do not remove the product's covers and panels

Never remove the product's covers and panels for any purpose.
Otherwise, the user's electric shock or fire may be incurred.

■ Warning on using the product

Warning items given below are to avoid danger to user's body and life and avoid the damage or deterioration of the product. Use the product, observing the following warning and caution items.

■ Warning items on power supply

● Power supply voltage

The rated power supply voltages of the product are 100, 120, 220 and 240VAC. The rated power supply voltage for each product should be confirmed by reading the label attached on the back of the product or by the “rated” column shown in the instruction manual. The specification of power cord attached to the products is rated to 125VAC for all products which are designed to be used in the areas where commercial power supply voltage is not higher than 125VAC. Accordingly, you must change the power cord if you want to use the product at the power supply voltage higher than 125VAC. If you use the product without changing power cord to 250VAC rated one, electric shock or fire may be caused. When you used the product equipped with power supply voltage switching system, please refer to the corresponding chapter in the instruction manuals of each product.

● Power cord

(IMPORTANT) The attached power cord set can be used for this device only.

If the attached power cord is damaged, stop using the product and call us or your local dealer.
If the power cord is used without the damage being removed, an electric shock or fire may be caused.

● Protective fuse

If an input protective fuse is blown, the product does not operate. For a product with external fuse holder, the fuse may be replaced. As for how to replace the fuse, refer to the corresponding chapter in the instruction manual.
If no fuse replacement procedures are indicated, the user is not permitted to replace it. In such case, keep the case closed and consult us or your local dealer. If the fuse is incorrectly replaced, a fire may occur.

■ Warning item on Grounding

If the product has the GND terminal on the front or rear panel surface, be sure to ground the product to safely use it.

■ Warnings on Installation environment

● Operating temperature and humidity

Use the product within the operating temperature indicated in the “rating” temperature column.
If the product is used with the vents of the product blocked or in high ambient temperatures, a fire may occur.
Use the product within the operating humidity indicated in the “rating” humidity column.
Watch out for condensation by a sharp humidity change such as transfer to a room with a different humidity.
Also, do not operate the product with wet hands. Otherwise, an electric shock or fire may occur.

● Use in gas

Use in and around a place where an inflammable or explosive gas or steam is generated or stored may result in an explosion and fire. Do not operate the product in such an environment.
Also, use in and around a place where a corrosive gas is generated or spreading causes a serious damage to the product. Do not operate the product in such an environment.

● Installation place

Do not insert metal and inflammable materials into the product from its vent and spill water on it.
Otherwise, electric shock or fire may occur.

USING THE PRODUCT SAFELY

■ Do not let foreign matter in

Do not insert metal and inflammable materials into the product from its vent and spill water on it.
Otherwise, electric shock or fire may occur.

■ Warning item on abnormality while in use

If smoke or fire is generated from the product while in use, stop using the product, turn off the switch, and remove the power cord plug from the outlet. After confirming that no other devices catch fire, ask us or your local dealer.

■ Input / Output terminals

Maximum input to terminal is specified to prevent the product from being damaged.
Do not supply input, exceeding the specifications that are indicated in the "Rating" column in the instruction manual of the product. Also, do not supply power to the output terminals from the outside.
Otherwise, a product failure is caused.

■ Calibration

Although the performance and specifications of the product are checked under strict quality control during shipment from the factory, they may be deviated more or less by deterioration of parts due to their aging or others.
It is recommended to periodically calibrate the product so that it is used with its performance and specifications stable.
For consultation about the product calibration, ask us or your local dealer.

■ Daily Maintenance

When you clean off the dirt of the product covers, panels, and knobs, avoid solvents such as thinner and benzene. Otherwise, the paint may peel off or resin surface may be affected. To wipe off the covers, panels, and knobs, use a soft cloth with neutral detergent in it.
During cleaning, be careful that water, detergents, or other foreign matters do not get into the product.
If a liquid or metal gets into the product, an electric shock and fire are caused.
During cleaning, remove the power cord plug from the outlet.

Use the product correctly and safely, observing the above warning and caution items.
Because the instruction manual indicates caution items even in individual items, observe those caution items to correctly use the product.

If you have questions or comments about the manuals, ask us or E-Mail us.

1. GETTING STARTED

This chapter describes the DL-2052 in a nutshell, including its main features, and front / rear / display panel introduction. After going through the overview, follow the Power-up sequence and Functionality check section to properly setup the DL-2052.

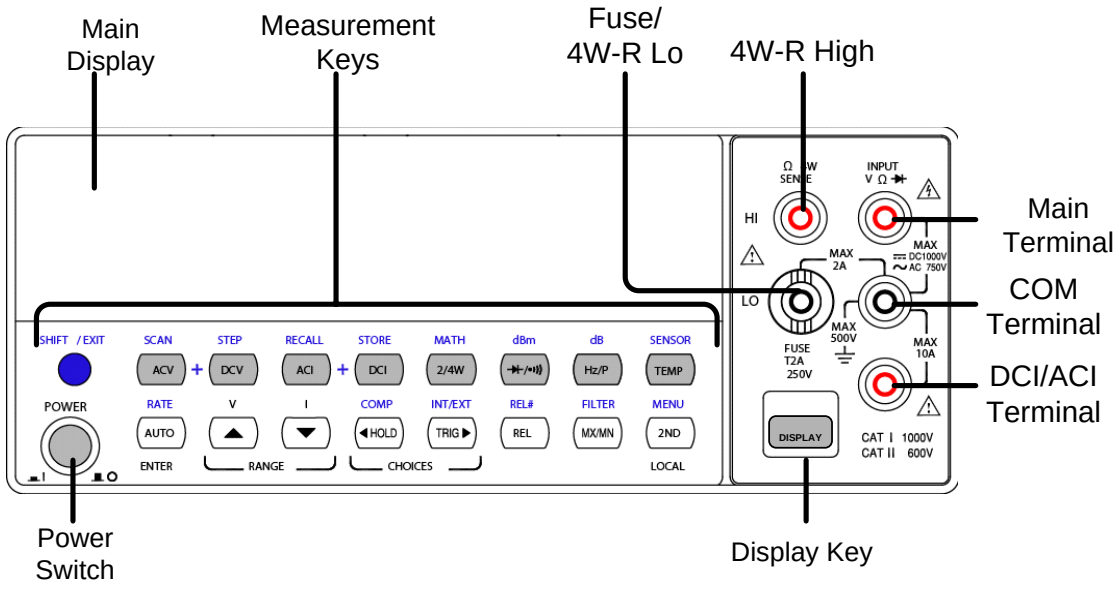
Please note the information in this manual was correct at the time of printing. However as TEXIO continues to improve its products, changes can occur at any time without notice. Please see the TEXIO website for the latest information and content.

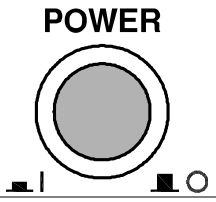
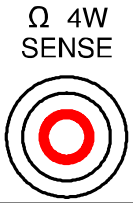
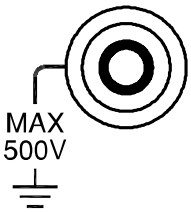
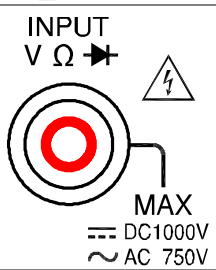
1-1. DL-2052 Characteristics

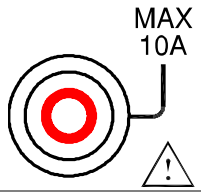
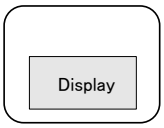
The DL-2052 is portable, dual-display digital multimeters suitable for wide range of applications, such as production testing, research, and field verification.

Performance	• High DCV accuracy: 0.012% • High current range: 10A • High Voltage range: 1000V • High ACV frequency response: 100kHz
Features	• 119999 meter count • Multi functions: ACV, DCV, ACI, DCI, 2W/4W R, Hz, Continuity, Diode test, MAX/MIN, REL, dBm, HOLD, AutoHold, Compare. • Manual or Auto ranging • AC true RMS or AC + DC true RMS
Interface	• Voltage/Resistance/Diode/Temperature input • Current input • 4W sense input • USB device/RS232 for remote control • 9-pin digital I/O

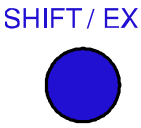
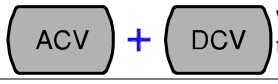
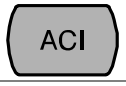
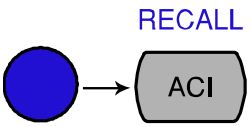
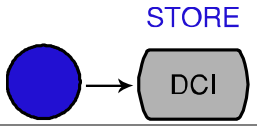
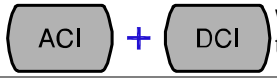
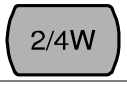
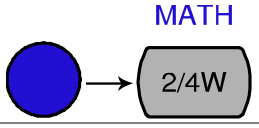
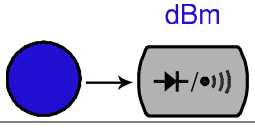
1-2. Front Panel Overview

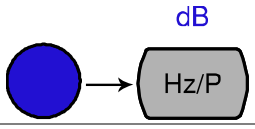
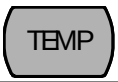
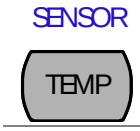


Power Switch		Turns On or Off the main power. For power up sequence, see page7.
Main Display		Shows measurement results and parameters. For display configuration details, see page31 (light setting).
Input fuse / 4W Ω sense LO terminal		As a fuse, protects the instrument from over-current. Rating: T2A, 250V. For fuse replacement procedure, see page47. As a sense terminal, accepts 4W Ω measurement LO connection. Also accepts current input less than 2A. For details, see page12.
4W Ω Sense HI Terminal		Accepts HI sense line in 4W resistance measurement. For details, see page12.
COM Terminal		Accepts ground (COM) line in all measurements except the sense line in 4W Resistance (page12).
Voltage/ 2W Ω / (Diode) Terminal		Accepts input in all measurements except for DC/AC Current and 4W Resistance sense line.

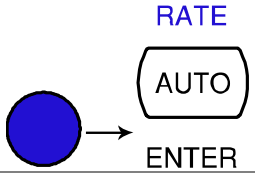
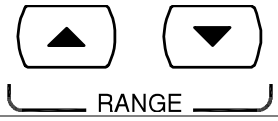
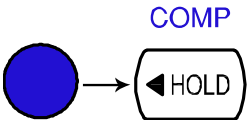
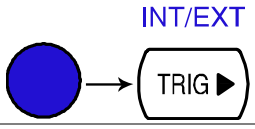
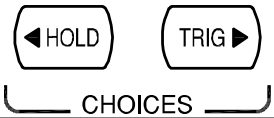
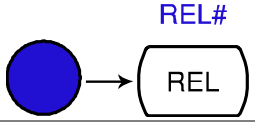
Current Terminal		Accepts DC/AC Current input. For DCI/ACI details, see page11.
Display key		Turns the display on or off. When the display is turned off, all panel keys except the Display key become disabled. The Display key is On by default.

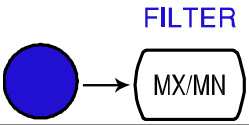
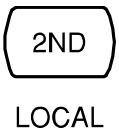
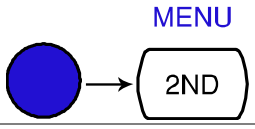
1-3. Measurement keys (Upper row)

SHIFT/EXIT		As the Shift key, selects the second functionality assigned to each front panel key. When pressed, the SHIFT indicator appears in the display. As the Exit key, gets out of the parameter configuration mode and goes back to the measurement result display mode.
ACV		Measures AC Voltage (page9).
DCV		Measures DC Voltage (page9).
ACV + DCV		When the ACV key and the DCV key are pressed together, they measure AC+DC Voltage (page9).
ACI		Measures AC Current (page11).
SHIFT → ACI (RECALL)		Recalls a normal measurement result (page32)
DCI		Measures DC Current (page11).
SHIFT → DCI (STORE)		Stores a measurement result (page32).
ACI + DCI		When the ACI key and the DCI key are pressed together, they measure AC+DC Current (page11).
2/4W (Resistance)		Measures 2-wire or 4-wire Resistance (page12).
SHIFT → 2/4W (MATH)		Enters the Math measurement mode (page24).
→|/•))) (Diode/ Continuity)		Tests Diode (page13) or Continuity (page13).
SHIFT → →|/•))) (dBm)		Measures dBm (page20).

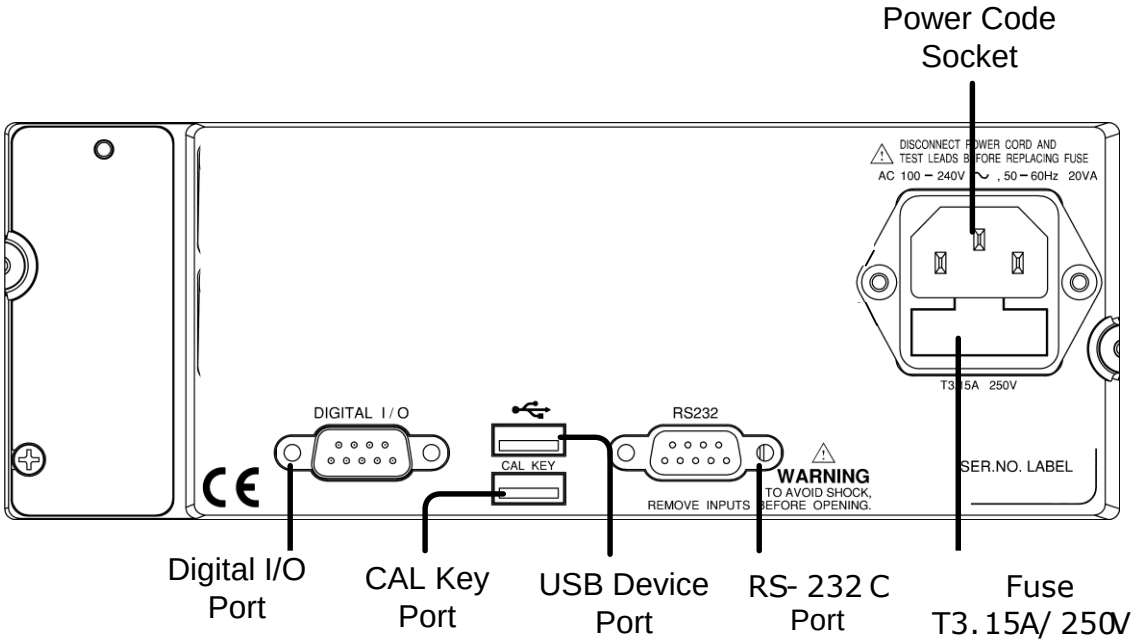
Hz/P (Frequency/ Period)		Measures Frequency or Period (page15).
SHIFT + Hz/P (dB)		Measures dB (page20).
(Temperature)		Measures Temperature (page16).
SHIFT + TEMP (SENSOR)		Selects the type of thermocouple used in the Temperature measurement (page17).

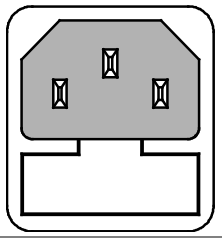
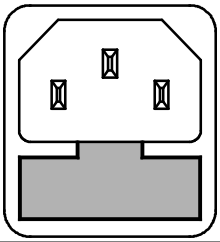
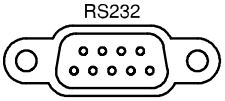
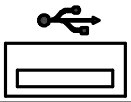
1-4. Measurement keys (Lower row)

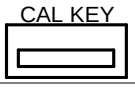
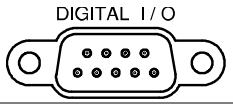
AUTO/ENTER		As the AUTO key, selects the measurement range automatically. As the ENTER key, confirms the entered value.
SHIFT → AUTO (RATE)		Selects the measurement update rate: Slow, Medium, or Fast (page8).
Up/Down		Selects the parameter in various occasions: higher (▲) or lower (▼).
HOLD		Activates the Hold function (page22).
SHIFT → HOLD (COMPare)		Activates the Compare measurement (page22).
TRIG (Trigger)		Triggers sample acquisition manually (page28).
SHIFT → TRIG (Int/Ext Trigger)		Selects the Internal or the External trigger source (page28).
Left/Right		Selects the parameter in various occasions: left (◀) or right (▶).
REL		Measures the Relative value (page21).
SHIFT → REL (RELative base)		Manually sets the reference value for the Relative value measurement (page21).
MX/MN (MAX/ MIN)		Measures the Maximum or the Minimum value (page21).

SHIFT → MX/MN (FILTER)		Selects the digital filter type for the signal sampling (page30).
2ND (Display) / LOCAL		As the 2nd key, selects the measurement item on the 2nd display (page27). Pressing and holding for more than 1 second turns off the 2nd display. As the Local key, releases the remote control and goes back to the local panel operation
SHIFT → 2ND (Menu)		Enters the configuration mode. Configures or displays the following items: Display (page28), Beep (page15), Continuity threshold (page14), Digital I/O (page33), and System information

1-5. Rear Panel Overview

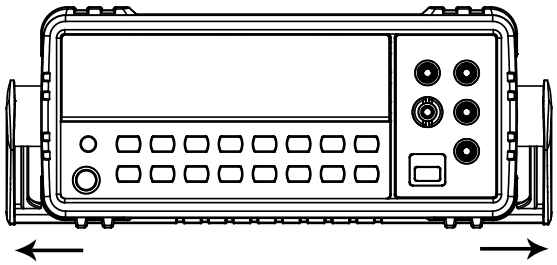


Power Cord Socket		Accepts the power cord. AC 100–240V, 50–60Hz. For power on sequence, see page7.
Fuse Socket		Holds the main fuse: T3.15A 250V, 20VA. For fuse replacement details, see page46.
RS-232C port		Accepts an RS-232C cable for remote control; DB-9 male connector. For remote control details, see page38.
USB device port		Accepts a USB device cable for remote control; Type A, female connector. For remote control details, see page37.

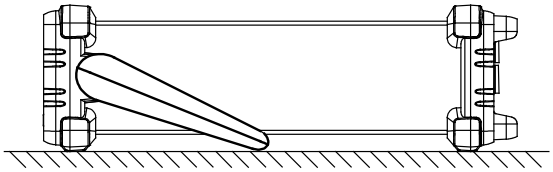
CAL key port		Reserved for internal uses as in firmware update and calibration.
Digital I/O port		Accepts a digital I/O cable for the Hi/Lo limit test; DB-9 pin, female connector. For digital I/O details, see page34.

1-6. Set Up

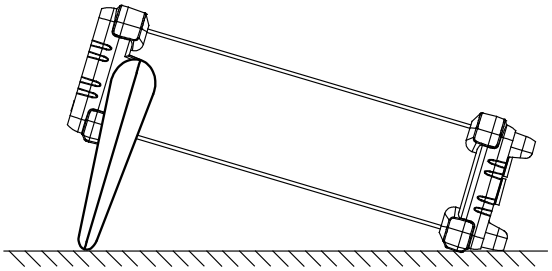
Tilt stand steps



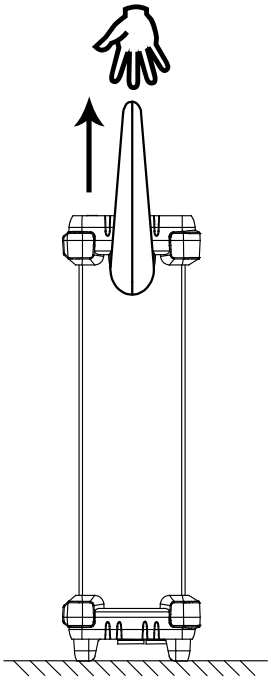
Pull out the handle sideways and rotate it.



Place the unit horizontally,



Or in the tilt stand position.

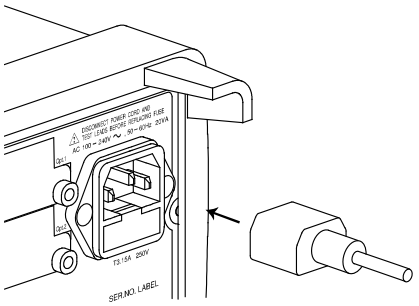


Place the handle vertically for hand carry.

1-7. Power Up

Power up steps

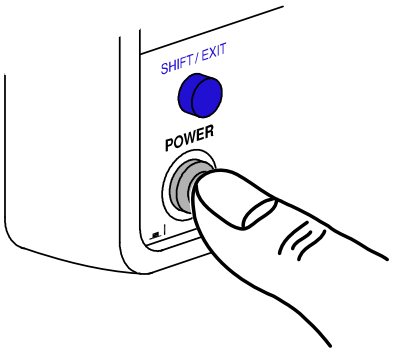
1. Connect the power cord to the AC Voltage input.



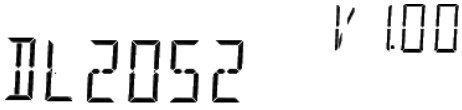
Note

Make sure the ground connector of the power cord is connected to a safety ground. This will affect the measurement accuracy.

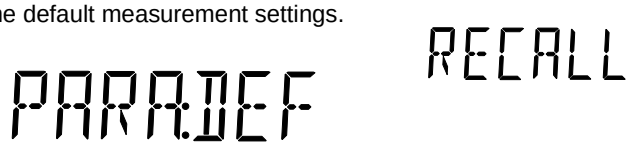
2. Push to turn On the main power switch on the front panel.



3. The display shows the model name and the version for a few seconds.
Example: DL-2052, V1.00

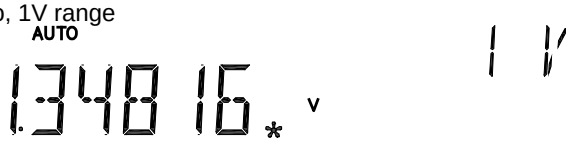


4. Followed by the default measurement settings.



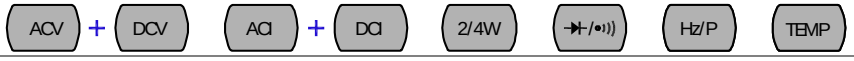
5. And the interface I/O settings.

6. Then the default setting appears.
Example: DCV, Auto, 1V range

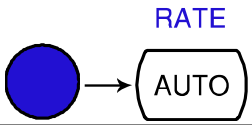


2. BASIC MEASUREMENT

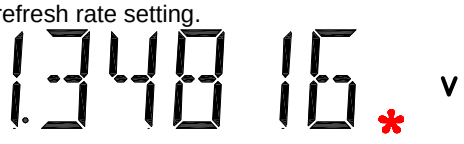
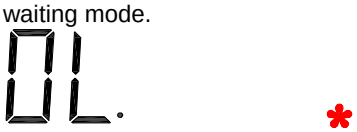
2-1. Basic Measurement Overview

Background	Basic measurement refers to the eight types of measurements assigned to the upper row keys on the front panel. 	
Measurement type	ACV	AC Voltage
	DCV	DC Voltage
	ACV+DCV	AC+DC Voltage
	ACI	AC Current
	DCI	DC Current
	ACI+DCI	AC+DC Current
	2/4W	2-wire and 4-wire Resistance
		Diode/Continuity
	Hz/P	Frequency/Period
	TEMP	Celsius/Fahrenheit Temperature
Advanced measurement	Advanced measurement (page19) mainly refers to the operation using the result obtained from one or more of the basic measurement.	

2-2. Common attribute: refresh rate

Background	Refresh rate defines how frequently the DL-2052 captures and updates the measurement data. Faster refresh rate yields lower accuracy and resolution. Slower refresh rate yields higher accuracy and resolution. Consider these trade-offs when selecting the refresh rate.	
Range	S	5 1/2 digits(119999 count)
	M	4 1/2 digits
	F	3 1/2 digits
Selection step	1. Press the Shift key followed by the AUTO (RATE) key. The refresh rate switches to the next.	
	2. The refresh rate indicator shows the current status.	

2-3. Common attribute: reading indicator

Background	The reading indicator ✱ next to the 1st display flashes according to the refresh rate setting. 
When no data is captured	When there is no captured data, the reading indicator flashes once every two seconds (slower than the normal refresh rate), indicating the DMM is in the waiting mode. 

2-4. Common attribute: manual/automatic triggering

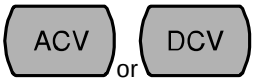
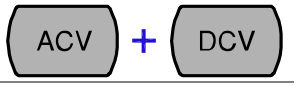
Automatic triggering (default)	The DL-2052 triggers according to the refresh rate. See the previous page for refresh rate setting details.

Manual triggering	Press the TRIG key to trigger measurement manually.	

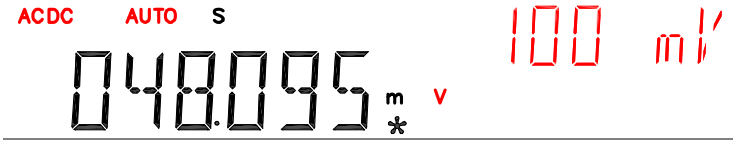
2-5. AC/DC/AC+DC Voltage Measurement

Voltage type	AC	0 ~ 750V
	DC	0 ~ 1000V
	AC+DC	0 ~ 1000V

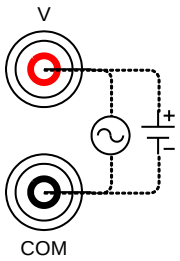
$*AC+DC=\sqrt{AC^2+DC^2}$ (AC = true RMS)

1. Activate ACV/ DCV	Press the ACV (AC Voltage) key or DCV (DC Voltage) key.	
	For AC+DC Voltage, press the ACV key and the DCV key together.	

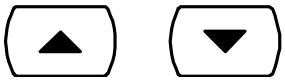
2. ACV/DCV mode display appears



AC(DC) + V	Indicates AC, DC, AC+DC Voltage
AUTO	Indicates Automatic range selection
100mV	2nd display shows the Voltage range

3. Connect the test lead and measure	Connect the test lead between the V and the COM port. The display updates the reading.	
 Note	When measuring in1000V (maximum) range immediately followed by 100mV (minimum) range, an error might occur due to extreme range switching. In such case, take at least one minute in between as an interval.	

2-6. Select Voltage range

Auto range	To turn the automatic range selection On/Off, press the AUTO key.	
Manual range	Press the Up or the Down key to select the range. AUTO indicator turns Off automatically. If the appropriate range is unknown, select the highest range.	

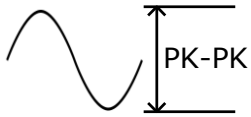
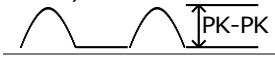
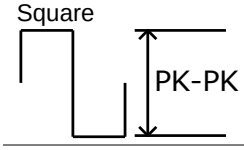
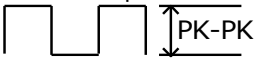
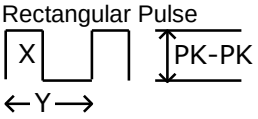
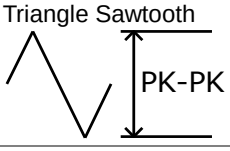
Selection list

Range	Resolution / Full scale @ slow rate	
	Resolution	Full scale
100mV	1μV	120.000mV
1V	10μV	1.20000V
10V	100μV	12.0000V
100V	1mV	120.000V
750V (AC)	10mV	750.00V
1000V(DC, AC+DC)	10mV	1000.0V

Note: For more detailed parameters, see the specifications at page49.

2-7. Voltage conversion table

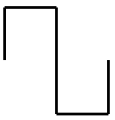
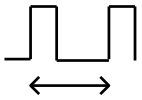
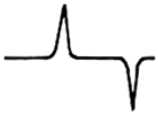
This table shows the relationship between AC, DC, and AC+DC reading in various waveforms.

Waveform	Peak to Peak	AC (True RMS)	DC	AC + DC (True RMS)
Sine 	2.828	1.000	0.000	1.000
Rectified Sine (full wave) 	1.414	0.435	0.900	1.000
Rectified Sine (half wave) 	2.000	0.771	0.636	1.000
Square 	2.000	1.000	0.000	1.000
Rectified Square 	1.414	0.707	0.707	1.000
Rectangular Pulse 	2.000	2K K= $\sqrt{(D-D^{2)}}$ D=X/Y	2D D=X/Y	$2\sqrt{D}$ D=X/Y
Triangle Sawtooth 	3.464	1.000	0.000	1.000

2-8. Crest factor table

Background

Crest factor is the ratio of the peak signal amplitude to the RMS value of the signal. It determines the accuracy of AC measurement.
If the crest factor is less than 3.0, voltage measurement will not result in error due to dynamic range limitations at full scale.
If the crest factor is more than 3.0, it usually indicates abnormal waveform as seen from the below table.

Waveform	Shape	Crest factor
Square wave		1.0
Sine wave		1.414
Triangle sawtooth		1.732
Mixed frequencies		1.414 ~ 2.0
SCR output 100% ~ 10%		1.414 ~ 3.0
White noise		3.0 ~ 4.0
AC Coupled pulse train		3.0
Spike		>9.0

2-9. AC/DC/AC+DC Current Measurement

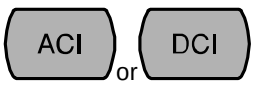
Current type

AC	0 ~ 10A
DC	0 ~ 10A
AC+DC	0 ~ 10A

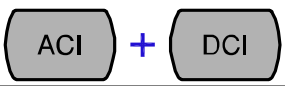
$$*AC+DC=\sqrt{AC^2+DC^2}$$ (AC = true RMS)

1. Activate ACI/ DCI

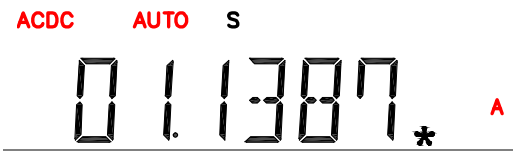
Press the ACI (AC Current) key or the DCI (DC Current) key.



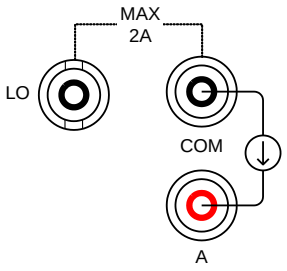
For AC+DC Current, press the ACI key and the DCI key together.



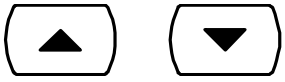
2. ACI/DCI mode display appears



AC(DC) + A	Indicates AC, DC, AC+DC Current (Note: AC = true RMS)

	AUTO	Indicates Automatic range selection
	10A	2nd display shows the Current range
3. Connect the test lead and measure	Connect the test lead between the A and COM port or LO to COM port, depending on the current. For current ≤ 2A use the LO port; For current up to 10A use the A port. The display updates the reading.	

2-10. Select Current range

Auto range	To turn the automatic range selection On/Off, press the AUTO key.	
Manual range	Press the Up or the Down key to select the range. AUTO indicator turns Off automatically. If the appropriate range is unknown, select the highest range.	

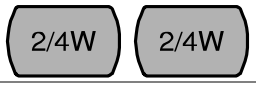
Selection list

Range	Resolution / Full scale @ slow rate	
	Resolution	Full scale
10mA	0.1µA	12.0000mA
100mA	1µA	120.000mA
1A	100µA	1.2000A
10A	100µA	10.0000A

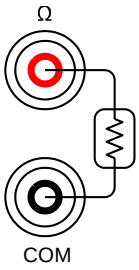
Note

*10A range is not available for AC+DC Current.
For more detailed range, see the specifications at page50.

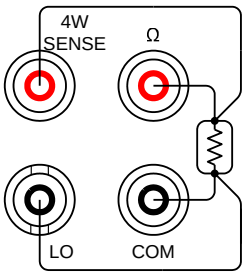
2-11. 2W/4W Resistance Measurement

Measurement type	2-wire	Uses the standard V-COM ports. Recommended for measuring resistances larger than 1kΩ.
	4-wire	Compensates the test lead effect using the 4W compensation ports, in addition to the standard V-COM ports. Recommended for measuring sensitive resistances smaller than 1kΩ.
1. Activate resistance measurement	For 2-wire resistance measurement, press the 2W/4W key once.	
	For 4-wire resistance measurement, press the 2W/4W key twice.	
2. 2W resistance mode display appears	 	
	2W(4W) + Ω	Indicates 2W(4W) Resistance mode
	AUTO	Indicates Automatic range selection
	10M	2nd display shows the Resistance range
3. Connect the test lead and measure	Connect the test lead. For 2-wire resistance, use the Ω (V) and the COM port. For 4-wire resistance, use the Ω (V) and the COM port, plus the 4W sense, and LO port for sensing. The display updates the reading.	

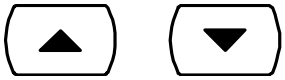
2W connection



4W connection



2-12. Select Resistance range

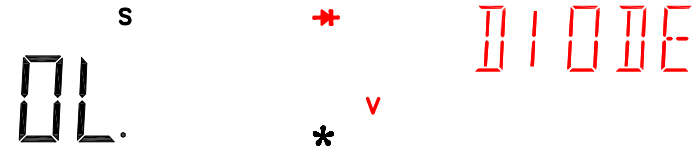
Auto range	To turn the automatic range selection On/Off, press the AUTO key.	
Manual range	Press the Up or the Down key to select the range. AUTO indicator turns Off automatically. If the range is unknown, select the highest range.	

Selection list

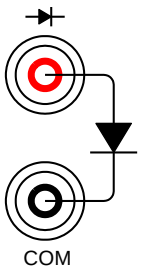
Range	Full scale @ slow rate
100Ω	120.000Ω
1kΩ	1.20000kΩ
10kΩ	12.0000kΩ
100kΩ	120.000kΩ
1MΩ	1.20000MΩ
10MΩ	12.0000MΩ
100MΩ	120.000MΩ

Note: For more detailed range, see the specifications at page51.

2-13. Diode Test

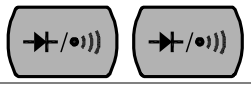
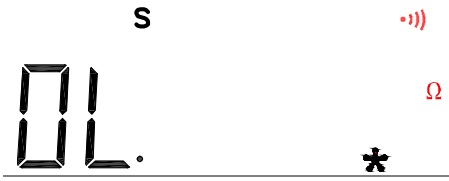
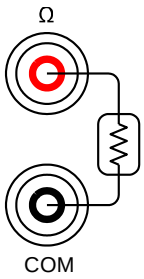
Background	Diode test checks the forward bias characteristics of a diode by running a constant forward bias current, approx. 0.5mA, through the DUT.
1. Activate diode test	Press the  key once. 
2. Diode mode display appears	

+ V	Indicates Diode test
DIODE	2nd display shows the title

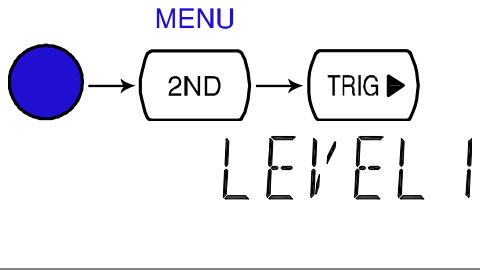
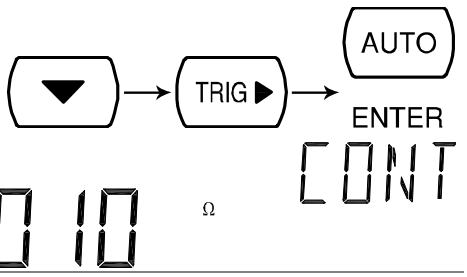
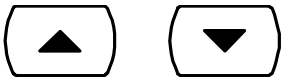
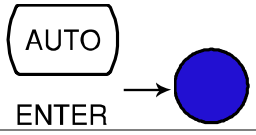
3. Connect the test lead and measure	Connect the test lead between the  and COM port; Anode-V, Cathode-COM. The display updates the reading.	

2-14. Continuity Test

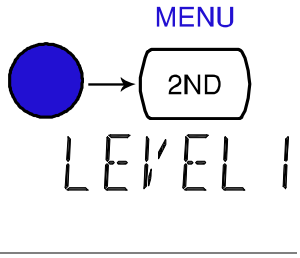
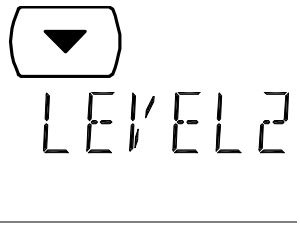
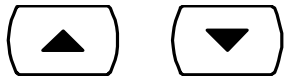
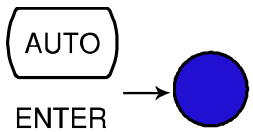
Background	Continuity test checks that the resistance in the DUT is low enough to be considered continuous (of conductive nature).

1. Activate continuity test	Press the →⊣/•)) key twice.	
2. Continuity mode display appears		
	→⊣/•)) + Ω	Indicates Continuity test
	CONT	2nd display shows the title
3. Connect the test lead and measure	Connect the test lead between the Ω and the COM port. The display updates the reading.	

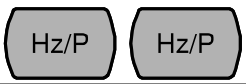
2-15. Set continuity threshold

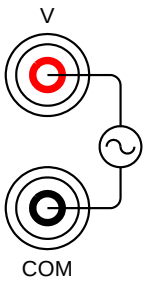
Background	Continuity threshold defines the maximum resistance allowed in the DUT when testing the continuity.	
Threshold Range	0Ω~ 1000Ω, 1Ω resolution, 10Ω default	
1. Activate threshold setting	1. Press the Shift key, the 2ND key, the Right key. The measurement menu appears.	
	2. Press the Down key, the Right key, the Enter key. The continuity threshold setting appears.	
2. Edit threshold	3. Move the cursor (the flashing digit) using the Left/Right key.	
	4. Change the value using the Up/Down key.	
	Range: 0Ω~ 1000Ω, 1Ω resolution, default 10Ω	
3. Go back to the default display	Press the Enter key to confirm the edited threshold. Press the Exit key to go back to the default display.	

2-16. Select beeper setting

Background	Beeper setting defines how the DL-2052 notifies the continuity test result to the user.	
Beeper parameter	Pass	Beeps when the test result is pass
	Fail	Beeps when the test result is fail
	Off	Beep function is turned Off
1. Activate beeper setting menu	1. Press the Shift key followed by the 2nd (Menu) key. The system menu appears.	
	2. Press the Down key. The beep menu appears.	
	3. Press the Down key. The beep setting appears.	
2. Select the beep setting	To change the setting, press the Up/Down key.	
	Beeper type:	Pass (beep when pass), Fail (beep when fail, default), Off (beep off)
3. Go back to the default display	Press the Enter key to confirm. Press the Exit key to go back to the default display.	

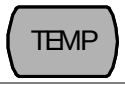
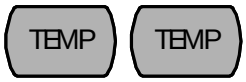
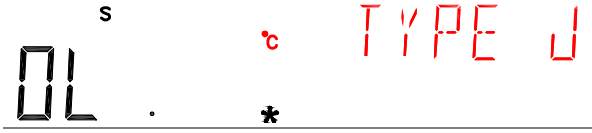
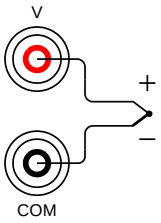
2-17. Frequency/Period Measurement

1. Activate frequency/period measurement	To measure Frequency, press the Hz/P key once.	
	To measure Period, press the Hz/P key twice.	
2. Frequency (Period) mode display appears		
	Hz (S)	Indicates Frequency (period) measurement
	FREQ (PERIOD)	2nd display shows the title

3. Connect the test lead and measure	Connect the test lead between the V and the COM port. The display updates the reading.	

Frequency range	10Hz ~ 800kHz		
	Sensitivity	10Hz ~ 100kHz: >0.1V 100kHz ~ 600kHz: >1.0V 600kHz ~ 800kHz: >2.5V	
Period Range	1.25µs ~ 0.1s		
	Sensitivity	1.25us ~ 1.666us: > 2.5V 1.666us ~ 10us: > 1.0V 10us ~ 0.1s: > 0.1V	
AC Current Sensitivity	Frequency	Input level	Sensitivity level
	10Hz~10kHz	10mA/100mA	> 7mA rms
	45Hz~10kHz	1A/10A	> 3mA rms

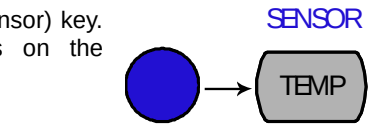
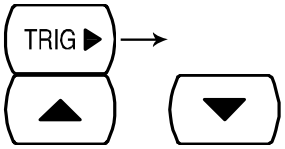
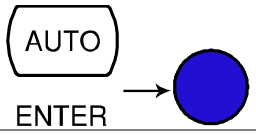
2-18. Temperature Measurement

Background	The DL-2052 accepts thermocouple input and calculates the temperature from the voltage fluctuation. Thermocouple type and reference junction temperature are also being considered.	
1. Activate temperature measurement	For Celsius units (°C), press the TEMP key once.	
	For Fahrenheit (°F) unit, press the TEMP key twice.	
2. Temperature mode display appears		
	°C (°F)	Indicates Temperature measurement
	TYPE J	2nd display shows the thermocouple type
3. Connect the test lead and measure	Connect the thermocouple lead between the V and the COM port. The display updates the reading.	
Range	0 ~ +300°C	

2-19. Select thermocouple type

Background	The DL-2052 assumes that a certain type of thermocouple, which reads voltage fluctuation induced by temperature changes, is used to measure the temperature.

Parameter	Type	Range	Resolution
	K	0 ~ +300°C	0.01°C
	T	0 ~ +300°C	0.01°C
	J	0 ~ +300°C	0.01°C

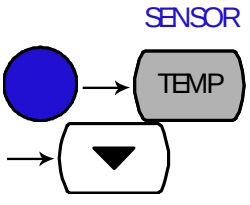
1. Open sensor selection menu	Press the Shift key, then the TEMP (Sensor) key. The sensor selection menu appears on the display.	  
2. Select sensor type	Press the Right key to highlight the thermocouple type. Press the Up/Down key. The thermocouple type switches to the next one.	 
3. Confirm and go back to the default display	Confirm by pressing the Enter key, menu of Set reference junction temperature is displayed. Press the Exit key to go back to the default display.	

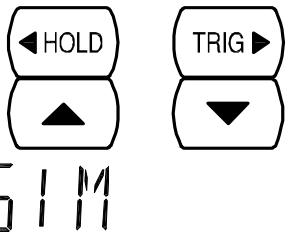
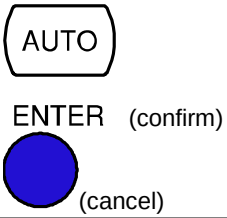
2-20. Set reference junction temperature

Background	When a thermocouple is connected to the DL-2052, the temperature difference between the thermocouple lead and the DL-2052 input terminal should be taken into account and be cancelled; otherwise an erroneous temperature might be added.

Type	Range	Resolution
SIM (simulated)	0 ~ +50°C	0.01°C

The terminal temperature is manually defined by the user.
Default value: 23.00

1. Open reference junction menu	Press the Shift key, the TEMP (Sensor) key, then the Down key. The reference junction selection menu appears on the display.	  

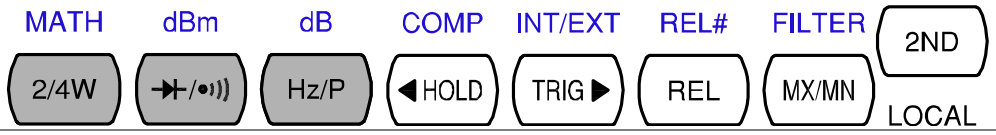
2. Edit reference temperature	Use the Left/Right key to move the cursor, and use the Up/Down key to change the value. Default: 23.00	
	Press the Enter key to confirm the value, or the Exit key to cancel. The display goes back to the default state.	

3. ADVANCED MEASUREMENT

3-1. Advanced Measurement Overview

Background

Advanced measurement mainly refers to the type of measurement which uses the result obtained by one of the basic measurements: ACV, DCV, ACI, DCI, 2/4W, Diode/Continuity, Frequency/Period, and Temperature.



Advanced Measurement	Basic Measurement					
	AC/DCV	AC/DCI	2/4W	Hz/P	TEMP	→+/•))
dB	•	—	—	—	—	—
dBm	•	—	—	—	—	—
Max/Min	•	•	•	•	•	—
Relative	•	•	•	•	•	—
Hold	•	•	•	•	•	—
Compare	•	•	•	•	•	—
Math	•	•	•	•	•	—
Dual Measurement	•	•	•	•	—	—

3-2. Common attribute: refresh rate

Background

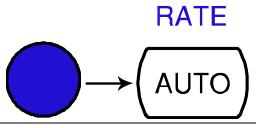
Refresh rate defines how frequently the DL-2052 captures and updates the measurement data. Faster refresh rate yields lower accuracy and resolution. Slower refresh rate yields higher accuracy and resolution. Consider these trade-offs when selecting the refresh rate.

Range

S	5 1/2 digits (119999 count)
M	4 1/2 digits
F	3 1/2 digits

Selection step

1. Press the Shift key followed by the AUTO (RATE) key. The refresh rate switches to the next.

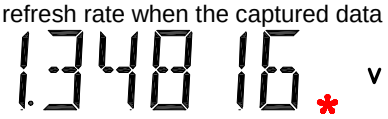


2. The refresh rate indicator shows the current status.

3-3. Common attribute: reading indicator

Background

The reading indicator ✱ next to the 1st display flashes according to the refresh rate when the captured data is updated on the display.



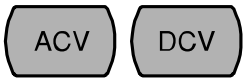
When no data is captured

When there is no captured data, the reading indicator flashes once every two seconds (slower than the normal refresh rate), indicating the DMM is in the waiting mode.

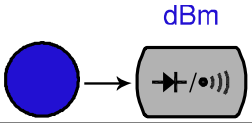
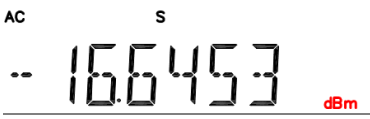
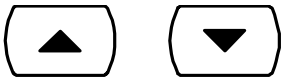
3-4. Common attribute: manual/automatic triggering

Automatic triggering (default)	The DL-2052 triggers according to the refresh rate. See the previous page for refresh rate setting details.
Manual triggering	Press the TRIG key to trigger measurement manually. 

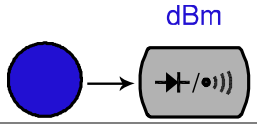
3-5. dBm/dB Measurement

Applicable to	 (NOT applicable to ACV+DCV)	
Background	Using the ACV or DCV measurement result, the DL-2052 calculates the dB or dBm value based on a reference resistance value in the following way.	
	dBm	10 x $\log_{10}$ (1000 x Vreading^2 / Rref)
	dB	dBm – dBmref
Parameters	Vreading	Input Voltage, ACV or DCV
	Vref	Reference voltage obtained by Rref/1mW
	Rref	Reference resistance simulating an output load
	dBmref	Reference dBm value

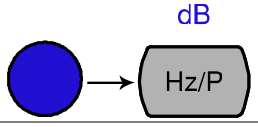
3-6. Measure dBm

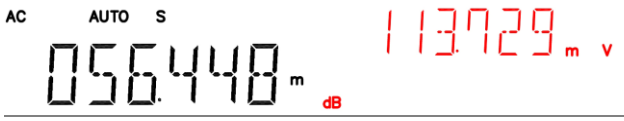
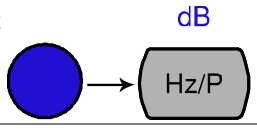
Activate dBm	Press the Shift key followed by the →|/•))) key. The 1st display shows dBm, and the 2nd display shows the reference resistance.	
dBm result appears		
	dBm	Indicates dBm measurement
	600Ω	2nd display indicates the reference resistance
Select reference resistance	To change the reference resistance, press the Up/Down key. The new resistance appears in the 2nd display. The following is the resistance list.	

2	4	8	16	50	75	93
110	124	125	135	150	250	300
500	600	800	900	1000	1200	8000

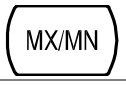
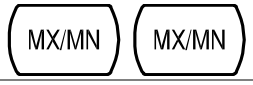
Deactivate dBm measurement	To cancel the dBm measurement, press the Shift key followed by the →|/•))) key, or simply activate another measurement.	

3-7. Measure dB

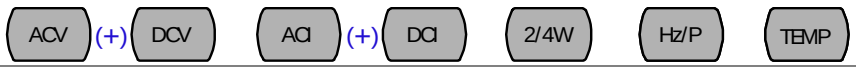
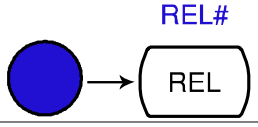
Background	dB is defined as [dBm−dBmref]. When the dB measurement is activated, the DL-2052 calculates the dBm using the reading at the first moment and stores it as dBmref.	
Activate dB	Press the Shift key followed by the Hz/P key. The 1st display shows dB, and the 2nd display shows the current Voltage reading.	

dB result appears		
	dB	Indicates dB measurement
	113.729mV	Indicates the present Voltage reading
dBmref	Press the 2ND key to see the dBmref value.	
Deactivate dB measurement	To cancel the dBm measurement, press the Shift key followed by the Hz/P key, or simply activate another measurement.	

3-8. Max/Min Measurement

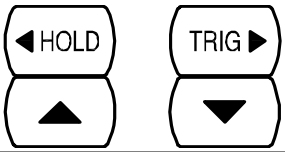
Applicable to	
Background	Maximum and Minimum measurement stores the highest (maximum) or lowest (minimum) reading and shows it on the 2nd display.
1. Activate Max/Min	For Max measurement, press the MX/MN key once. 
	For Min measurement, press the MX/MN key twice. 
2. Max (Min) result appears	
	MIN (MAX) — Indicates Min (Max) measurement
	0.11516 — 2nd display shows the Min (Max) measurement result
Deactivate Max/Min measurement	To cancel the Max/Min measurement, press the MX/MN key for 2 seconds, or simply activate another measurement. 

3-9. Relative Value Measurement

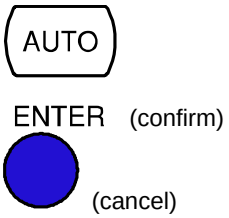
Applicable to	
Background	Relative measurement stores a value, typically the data at the moment, as the reference. The following measurement is shown as the delta between the reference.
1. Activate Relative measurement	Press the REL key. The measurement reading at the moment becomes the reference value. 
2. Relative measurement display appears	
	REL — Indicates Relative value measurement
	2nd display — Shows the reference value
	1st display — Shows the delta between the current measurement data and the reference value
Manually set the reference value	1. To set the reference value manually, press the Shift key followed by the REL key. The setting appears. 

REL	Indicates Relative measurement
1st display	Shows the reference value
2nd display	Indicates Relative value modification

2. Use the Left/Right key to move the flashing point (cursor), and use the Up/Down key to change the value.



3. Press the Enter key to confirm the value, or the Exit key to cancel. The display switches to measurement.



Deactivate Relative measurement

To cancel the Relative measurement, press the REL key again, or simply activate another measurement.

3-10. Hold Measurement

Applicable to

Background

Hold measurement retains the current measurement data and updates it only when the reading fluctuates more than the threshold setting as the percentage of the retained data.

1. Activate Hold measurement

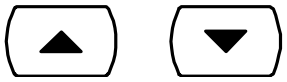
Press the HOLD key.

2. Hold measurement display appears

HOLD	Indicates Hold measurement
2nd display	Shows the Hold threshold
1st display	The measurement data which is updated only when it fluctuates more than the threshold compared to the retained value.

3. Select hold threshold

Select the hold threshold using the Up/Down key. The 2nd display changes accordingly.



Range	0 ~ 99%, 1% resolution

Deactivate Hold measurement

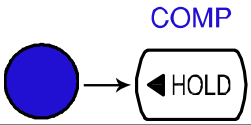
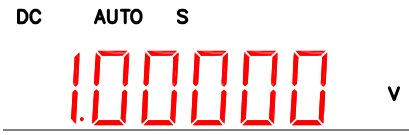
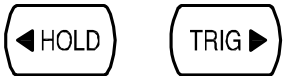
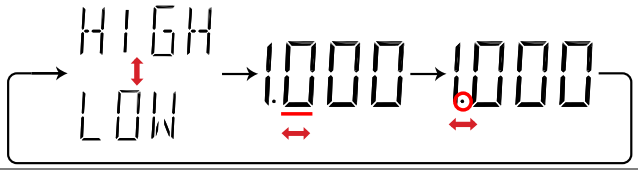
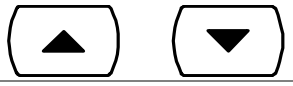
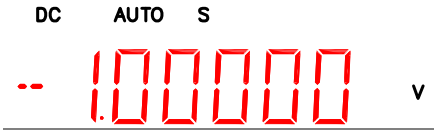
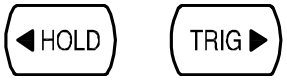
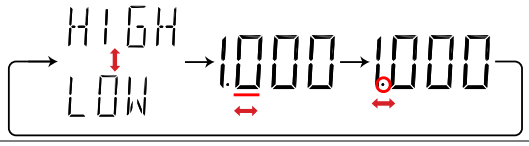
To cancel the Hold measurement, press the Hold key for 2 seconds, or simply activate another measurement.

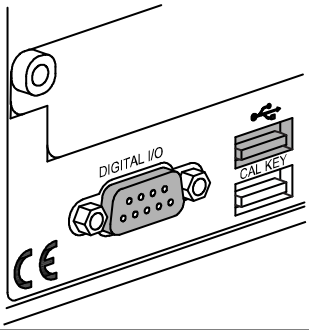
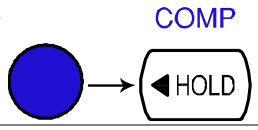
3-11. Compare Measurement

Applicable to

Background

Compare measurement checks and updates if the measurement data stays between the upper (high) and lower (low) limit specified.

1. Activate Compare measurement	Press the Shift key, then the HOLD (Comp) key.	
2. High limit setting		
	1st display	Shows the high limit value
	2nd display	Indicates high limit setting
	1. Use the Left/Right key to move the cursor (flashing point) between high/low setting, digits, and decimal point.	 
	2. Change the parameter using the Up/Down key.	
	3. Press the ENTER key to confirm editing and move to the low limit setting.	
3. Low limit setting		
	1st display	Shows the low limit value
	2nd display	Indicates low limit setting
	4. Use the Left/Right key to move the cursor (flashing point) between high/low setting, digits, and decimal point.	 
	5. Change the parameter using the Up/Down key.	
	6. Press the ENTER key to confirm editing. The compare measurement starts right away.	
4. Compare measurement appears		
	COMP	Indicates Compare mode
	2nd display	Shows the compare measurement result: Pass, High, or Low.

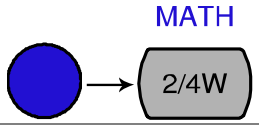
5. Result	High	If the 2nd display shows High, the result is above the High limit. 
		Digital I/O: FAIL Out (Pin 6) and HIGH Limit FAIL Out (Pin 7) are activated.
	Low	If the 2nd display shows Low, the result is below the Low limit. 
		Digital I/O: FAIL Out (Pin 6) and LOW Limit FAIL Out (Pin 8) are activated.
	Pass	If the 2nd display shows Pass, the result is staying between the High and the Low limit. 
		Digital I/O: PASS Out (Pin 5) is activated.
Digital I/O	The Compare measurement result comes out from the rear panel Digital I/O terminal. For the terminal details, see page33.	
Deactivate Compare measurement	To cancel the Compare measurement, press the Shift key followed by the HOLD (Comp) key, or simply activate another measurement.	

3-12. Math Measurement

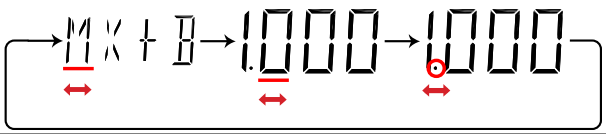
Applicable to: ACV (+) DCV, ACI (+) DCI, 2/4W, Hz/P, TEMP

Background	Math measurement runs three types of mathematical operation, MX+B, 1/X, and percentage, based on the other measurement results.	
Math type	MX+B	Multiplies the reading (X) by the factor (M) and adds/subtracts offset (B).
	1/X	Divides the reading (X) by 1, which provides the inverse number.
	Percentage	Runs the following equation. $\frac{(\text{ReadingX} - \text{Reference})}{\text{Reference}} \times 100\%$

3-13. Measure MX+B

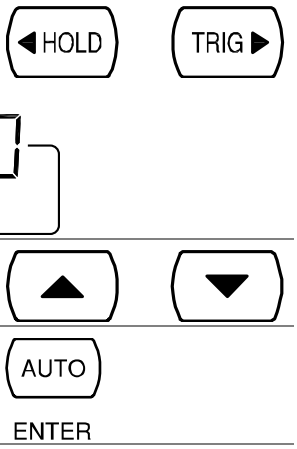
1. Activate MX+B	Press the Shift key followed by the 2/4W (Math) key. The MX+B setting appears.	
2. Set the factor (M)	 	
	1st display	Shows the factor (M)
	2nd display	Indicates MX+B (The letter M flashes)

1. Use the Left/Right key to move the cursor (flashing point) between the factor, digits, and decimal point.



2. Change the parameter using the Up/Down key.

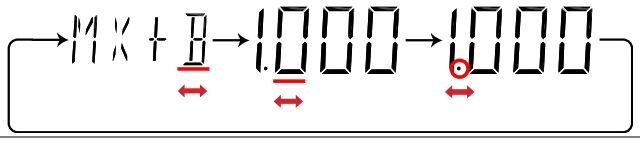
3. Press the ENTER key to confirm editing and move to offset setting.



3. Set the offset (B)

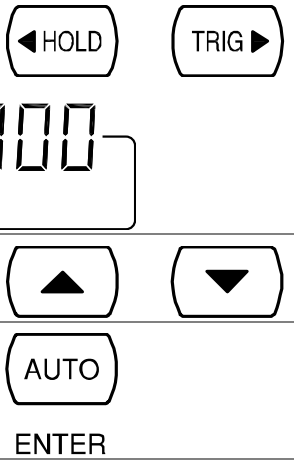
1st display	Shows the offset (B)
2nd display	Indicates MX+B (The letter B flashes)

4. Use the Left/Right key to move the cursor (flashing point) between the offset, digits, and decimal point.



5. Change the parameter using the Up/Down key.

6. Press the ENTER key to confirm the editing. The MX+B measurement result appears.



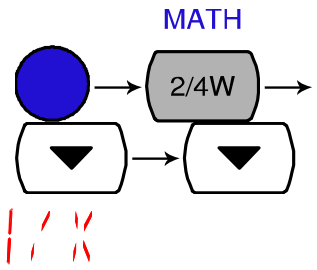
4. View MX+B

1st display	Shows the calculated result
2nd display	Indicates MX+B
MATH	Indicates Math operation

3-14. Measure 1/X

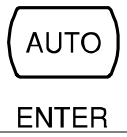
1. Activate 1/X

Press the Shift key, the 2/4W (Math) key, the Down key twice. The 1/X setting appears.



2. View 1/X

Press the ENTER key to view the 1/X measurement result.

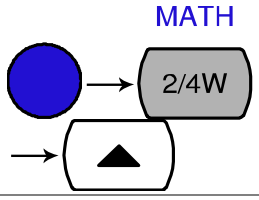


1st display	Shows the 1/X value
2nd display	Indicates 1/X
MATH	Indicates Math operation

3-15. Measure Percentage

1. Activate Percentage

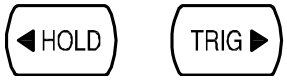
Press the Shift key, the 2/4W (Math) key, the Up key. The Reference setting appears. The Percentage is calculated as
: [Reading−Reference]/Reference x 100%.

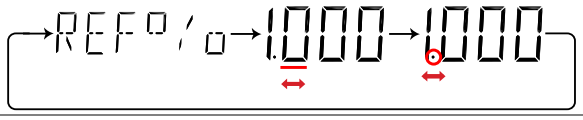


2. Set the reference number

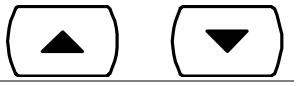
1st display	Shows the reference number
2nd display	Indicates Percentage setting

1. Use the Left/Right key to move the cursor (flashing point) between high/low setting, digits, and decimal point.





2. Change the parameter using the Up/Down key.



3. Press the ENTER key to confirm editing.

3. View Percentage

1st display	Shows the calculated result
2nd display	Indicates the Percentage measurement
MATH	Indicates Math operation

3-16. Dual Display Measurement

Background

You can use the 2nd display to show another item, thus viewing two different measurement results at once. The following table shows the available options.

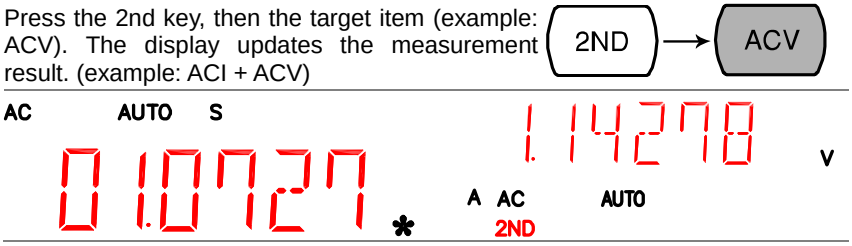
1st Display	2nd Display				
	ACV	DCV	ACI	DCI	Hz/P
ACV	•	•	•	•	•
DCV	•	•	•	•	•
ACV+DCV	—	—	—	—	—
ACI	•	•	•	•	•
DCI	•	•	•	•	•
ACI+DCI	—	—	—	—	—
2W* (see Note)	•	•	•	•	•
Hz/P	•	•	•	•	•
TEMP	—	—	—	—	—
→||←/•)))	—	—	—	—	—

Note

- In the dual display mode, the resistance needs to be larger than 1MΩ.
- Some combination of dual display mode is possible but may not be useful, and their accuracies are not guaranteed.

2nd Measurement item setting

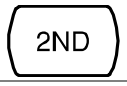
Press the 2nd key, then the target item (example: ACV). The display updates the measurement result. (example: ACI + ACV)



1st Display	Shows the primary measurement result
2nd Display	Shows the secondary measurement result
2ND	Indicates that dual measurement is active

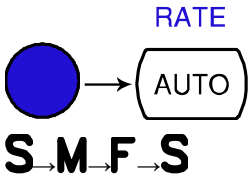
Turn Off 2nd Measurement

To turn Off the 2nd measurement, press and hold the 2nd key for more than 1 second.



4. SYSTEM/DISPLAY CONFIGURATION

4-1. Refresh Rate Setting

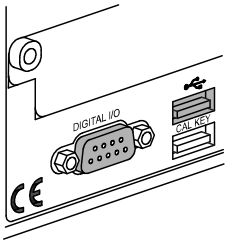
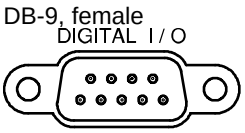
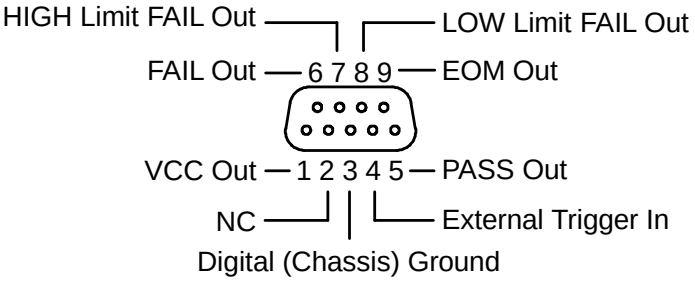
Background	Refresh rate defines how frequently the DL-2052 captures and updates the measurement data. Faster refresh rate yields lower accuracy and resolution. Slower refresh rate yields higher accuracy and resolution. Consider the trade-off when selecting the refresh rate.
Display/Range	 S 5 1/2 digits M 4 1/2 digits F 3 1/2 digits
Refresh rate selection	Press the Shift key followed by the AUTO key. The refresh rate indicator switches to the next rate setting. 

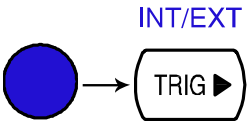
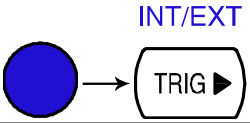
4-2. Trigger Setting

4-2-1. Manual/Automatic triggering

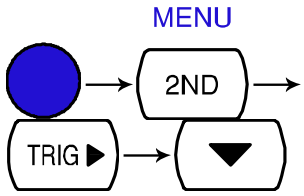
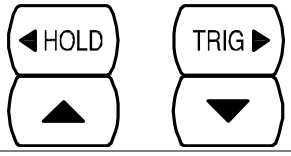
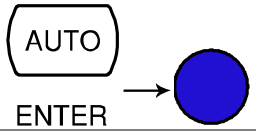
Automatic triggering (default)	The DL-2052 triggers according to the refresh rate. See the previous page for refresh rate setting details.
Manual triggering	Press the TRIG key to trigger measurement manually. 

4-2-2. Use external trigger

Background	The DL-2052 uses the internal trigger by default, for example to count the frequency and the period. Using an external trigger allows customized triggering condition.
Signal connection	Connect the external trigger signal to the Digital I/O port located on the rear panel.  
Digital I/O pin assignment	

1. Activate external trigger	Press the Shift key followed by the TRIG key. The EXT indicator appears on the display. PERIOD EXT	
2. Start trigger	Press the TRIG key to start triggering manually. The ✱ indicator turns On. AUTO S -- 00.000 1 S m ✱	
Reading indicator	The reading indicator ✱ does not flash before triggering (can be on or off). After triggering, the indicator flashes according to the external signal trigger timing.	
Exit external trigger	Press the Shift key followed by the TRIG key. The EXT indicator disappears and the trigger goes back to internal mode.	

4-2-3. Set trigger delay

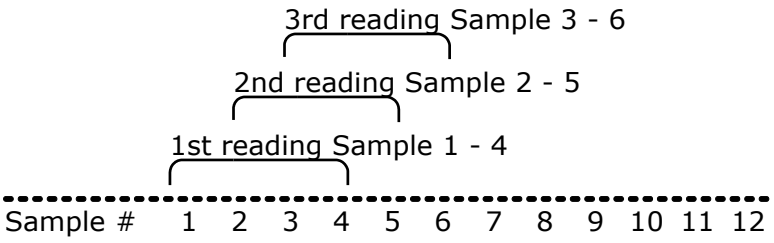
Background	Trigger delay defines the time rag between triggering and measurement start. The default is set at 10ms.	
Panel operation	1. Press the Shift key, the 2ND (Menu) key, the Right key, the Down key. The delay menu appears. DELAY	
	2. Press the Down key. The delay setting appears. 00 10.mS	
	3. Move the flashing point (cursor) using the Left/Right key. Change the value using the Up/Down key.	
	4. Press the ENTER key to confirm editing and press the EXIT key. The display goes back to previous mode.	
Range	1 ~ 1000ms, 1ms resolution	

4-3. Digital Filter Setting

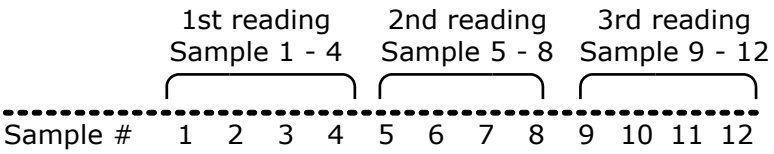
4-3-1. Overview

Filter basic	The DL-2052 internal digital filter converts the analog input signal into digital format before passing it to internal circuits for processing. The filter affects the amount of noise included in the measurement result.
Filter type	The digital filter averages a specific number of input signal samples to generate one reading. The filter type defines the averaging method. The following diagrams show the filter difference as an example of averaging 4 samples per reading.

Moving :MOV (default) — Moving filter takes in one new sample and discards the oldest sample per reading. This is the default behavior when the digital filter is not specified, and is recommended for most applications.



Repeating : REP — Repeating filter renews the whole samples per reading.

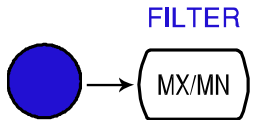


Filter count	Filter count defines the number of samples to be averaged per reading. More samples offer low noise but long delay. Less samples offer high noise but short delay.
	Range 2 ~ 100

4-3-2. Filter setting

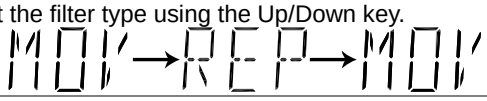
Turn on Filter

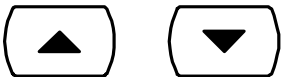
1. Press the Shift key followed by the MX/MN (Filter) key.



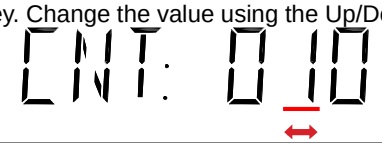
1st display	Shows the filter count
2nd display	Shows the filter type (flashing)

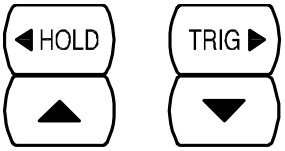
2. Select the filter type using the Up/Down key.



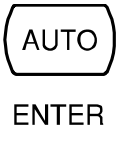


3. Move the cursor to filter count using the Left/Right key. Change the value using the Up/Down key.





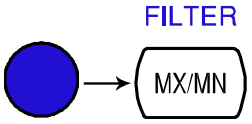
4. Press the ENTER key to confirm editing. The Filter indicator appears on the display.



FILT Indicates manual Filter setting

Turn off Filter

5. Press the Shift key followed by the MX/MN (Filter) key. The Filter indicator will disappear from the display.



4-4. Display Setting

4-4-1. Display light setting

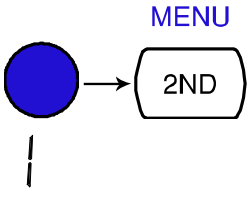
Background

Display light setting adjusts the brightness of the display reading. Use level 3 or more (brighter) when working indoor; use level 2 or 1 (darker) when working outdoor under the sun.

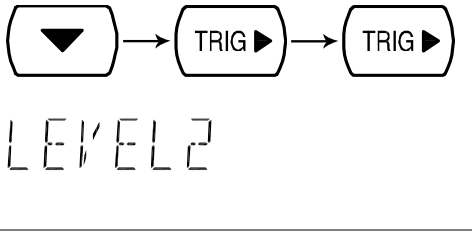
Level 5 (brightest) ~ 1 (darkest), default Level 3

Panel operation

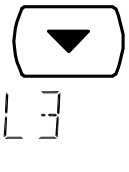
1. Press the Shift key followed by the 2ND (Menu) key. The system menu appears.



2. Press the Down key, then the Right key twice. The light menu appears.

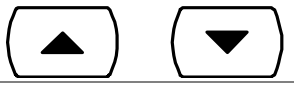


3. Press the Down key. The light level setting appears.

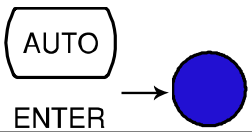


1st display Shows the current display light level

4. Select the level using the Up/Down key.



5. Press the Enter key to confirm your selection. Press the Exit key to go back to the default display.



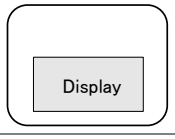
4-4-2. Display on/off setting (+ key lock)

Background

The display can be turned off when not used for a long time. Note that when this function is used, the panel keys are also locked except for the Output On/Off key. The display is turned on by default.

Panel operation

1. Press the Display key once. The display will be turned off and the panel keys become locked.



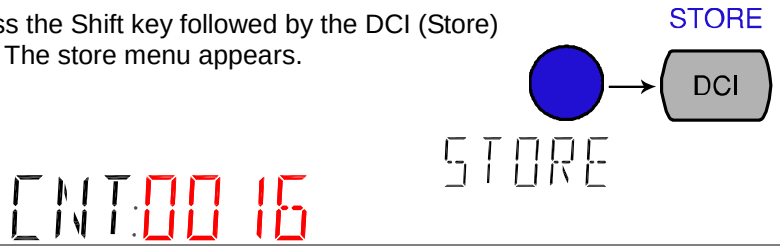
2. To enable the display and panel keys, press the Display key again.

5. STORE/RECALL

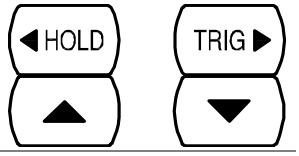
The DL-2052 can store and recall measurement history (for up to 1000 counts) as well as the instrument settings.

5-1. Store Measurement Record

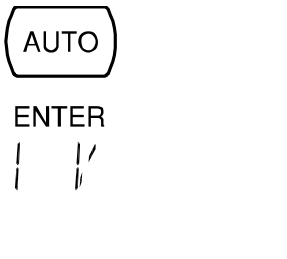
Background	The DL-2052 can store the measurement history which can be recalled later for observation and analysis as in Maximum, Minimum, and Average value. Note: Previously recorded measurements will be erased every time the store function is used or if power is reset.
	Data count 1 ~ 9999
Not applicable to	Store/recall measurement history is not applicable to Diode/Continuity test ⊣/•)).
Store step	1. Press the Shift key followed by the DCI (Store) key. The store menu appears.



	2. Move the cursor using the Left/Right key. Change the data count using the Up/Down key.



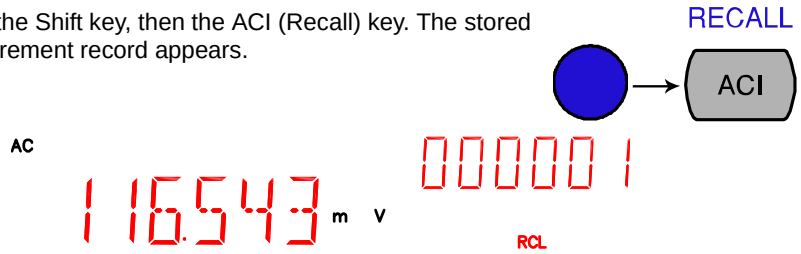
	3. Press the Enter key to confirm editing and to go back to the previous display.



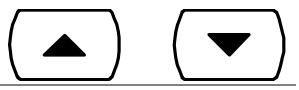
STO	Indicates the measurement history is stored

5-2. Recall Measurement Record

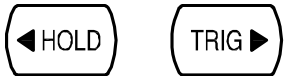
Background	The DL-2052 can recall the stored measurement history for observation and analysis as in Maximum, Minimum, and Average value.
Not applicable to	Store/recall measurement history is not applicable to Diode/Continuity test ⊣/•)).
Recall stored record	Press the Shift key, then the ACI (Recall) key. The stored measurement record appears.

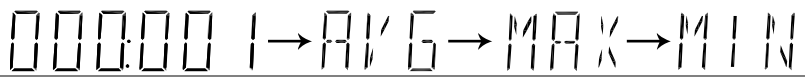


1st display	Shows the stored measurement result
2nd display	Shows the reading count
RCL	Indicates the data has been recalled
View each reading	Change the reading count using the Up/Down key.

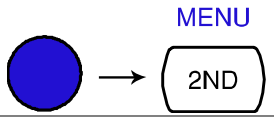
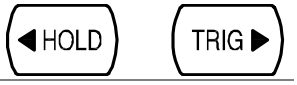
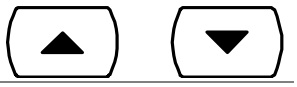
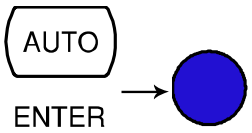


View Max/Min/ Average	Switch to the Average/Maximum/ Minimum value of the recorded data using the Right key. Use the left key to go back.

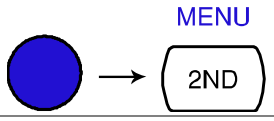
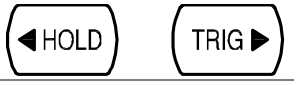
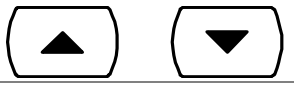
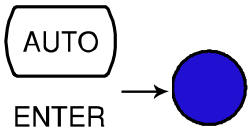




5-3. Store Settings

Background	The DL-2052 can store the 10 Panel settings.	
	Parameter 01 ~ 10	
Store step	1. Press the Shift key followed by the 2nd (MENU) key. The SYSTEM menu appears.	
	2. Move the cursor using the Left/Right key. The SAVE menu appears.	
	3. Change the number using the Up/Down key.	
	4. Press the Enter key to confirm editing and to go back to the previous display.	

5-4. Recall Settings

Background	The DL-2052 can be called the initial configuration and 10 different panel settings. Also, when a call set-up once, same set is called the next time the power is turned on. It becomes the factory settings when you call the 00.	
	Parameter 00 ~ 10	
Recall stored Settings	1. Press the Shift key followed by the 2nd (MENU) key. The SYSTEM menu appears.	
	2. Move the cursor using the Left/Right key. The RECALL menu appears.	
	3. Change the number using the Up/Down key.	
	4. Press the Enter key to confirm editing and to go back to the previous display.	

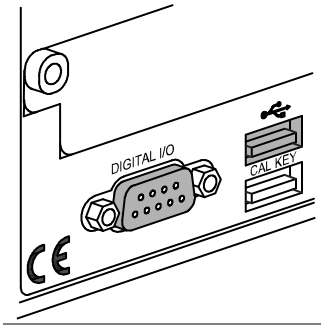
6. DIGITAL I/O

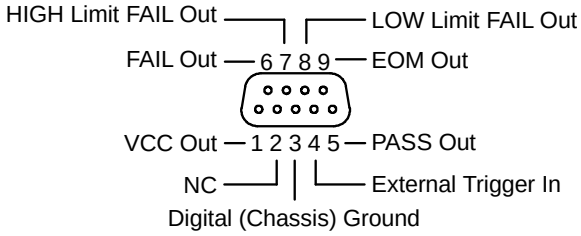
The rear panel Digital I/O terminal outputs the result of Compare measurement to external devices.

6-1. Digital I/O Terminal Configuration

Background The digital I/O terminal outputs the result of Compare measurement to control external devices. By providing separate VCC for the terminal, the outputs can also be used as power source for TTL and CMOS logics.

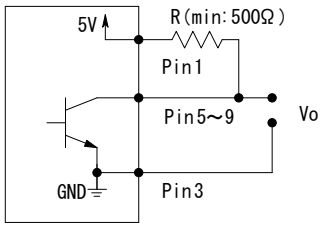
Pin assignment Connector type: DB-9 female

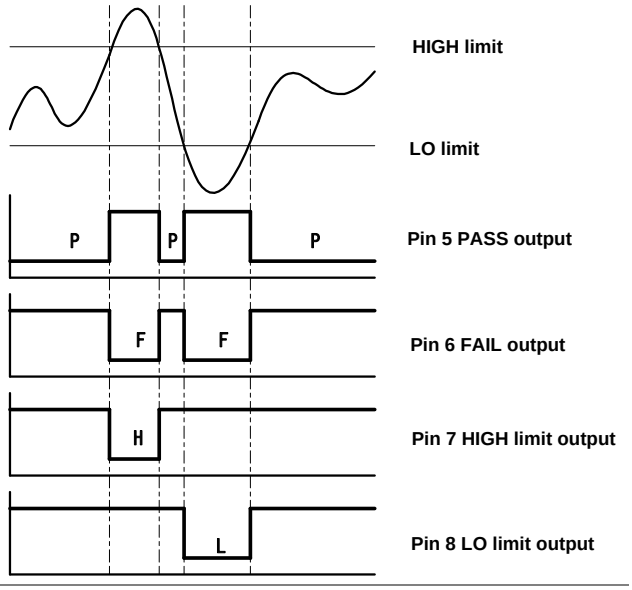




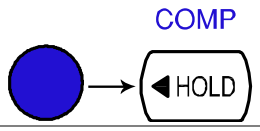
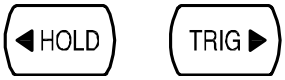
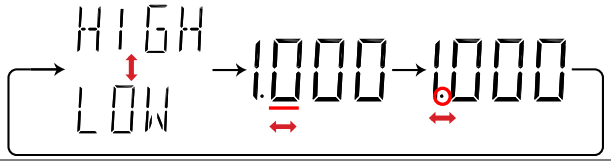
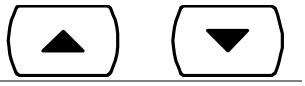
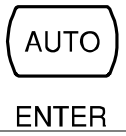
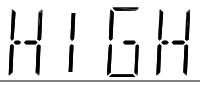
Pin1	VCC output, 5V. Serves as the power source for the external device/logic.
Pin2	NC (No Connection).
Pin3	Digital (Chassis) Ground.
Pin4	External Trigger Input. Accepts external trigger signal. For using external signals.
Pin5	PASS signal Output. Activates when the compare result is PASS. Active low.
Pin6	FAIL signal Output. Activates when the compare result is FAIL. Active low.
Pin7	HIGH Limit FAIL signal Output. Activates when the compare result is FAIL due to violating the HIGH Limit. Active low.
Pin8	LOW Limit FAIL signal Output. Activates when the compare result is FAIL due to violating the LOW Limit. Active low.
Pin9	EOM (End Of Measurement) signal Output. Activates when compare measurement is over. Active High. Pulse width ≒ 10ms(Display ON) / 3ms(Display OFF)

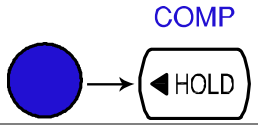
Digital I/O Terminal wiring diagram



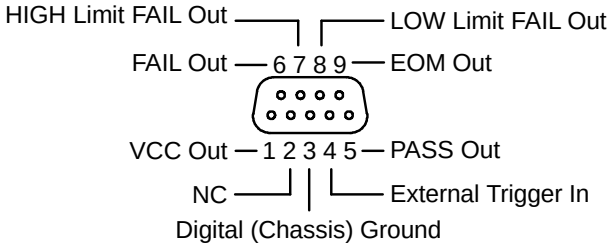
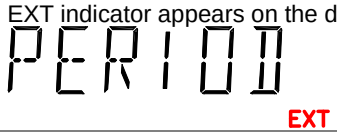
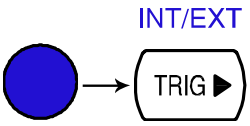
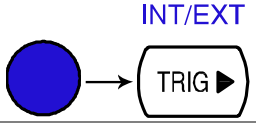


6-2. Application: Compare measurement

Applicable to		
Background	Compare measurement checks and updates if the measurement data stays between the upper (high) and lower (low) limit specified.	
1. Activate Compare measurement	Press the Shift key, then the HOLD (Comp) key.	
2. High limit setting		
	1st display — Shows the high limit value	
	2nd display — Indicates high limit setting	
	1. Use the Left/Right key to move the cursor (flashing point) between high/low setting, digits, and decimal point.	
		
	2. Change the parameter using the Up/Down key.	
	3. Press the ENTER key to confirm editing and move to the low limit setting.	
3. Low limit setting		
	1st display — Shows the low limit value	
	2nd display — Indicates low limit setting	
	Set the low limit in the same way as in the high limit. Press the ENTER key to confirm editing. The compare measurement starts right away.	
4. Compare measurement appears		
	COMP — Indicates Compare mode	
	2nd display — Shows the compare measurement result: Pass, High, or Low.	
5. Result	High — If the 2nd display shows High, the result is above the High limit.	
	Digital I/O: FAIL Out (Pin 6) and HIGH Limit FAIL Out (Pin 7) are activated.	
	Low — If the 2nd display shows Low, the result is below the Low limit.	

		Digital I/O: FAIL Out (Pin 6) and LOW Limit FAIL Out (Pin 8) are activated.
	Pass	If the 2nd display shows Pass, the result is staying between the High and the Low limit. 
		Digital I/O: PASS Out (Pin 5) is activated.
Deactivate Compare measurement	To cancel the Compare measurement, press the Shift key followed by the HOLD (Comp) key, or simply activate another measurement.	

6-3. Application: External trigger

Background	The DL-2052 uses the internal trigger by default, for example to count the frequency and the period. Using an external trigger allows customized triggering condition.	
Signal connection	Connect the external trigger signal to the Digital I/O port located on the rear panel. 	
	Pin4	External Trigger Input pin. TTL level, Active High, Pulse width > 25us
1. Activate external trigger	Press the Shift key followed by the TRIG key. The EXT indicator appears on the display. 	
2. Start trigger	Press the TRIG key to start triggering manually. The ✱ indicator turns On. 	
Reading indicator	The reading indicator ✱ stays On before triggering. After triggering, the indicator flashes according to the external signal trigger timing.	
Exit external trigger	Press the Shift key followed by the TRIG key. The EXT indicator disappears and the trigger goes back to internal mode.	

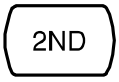
7. REMOTE CONTROL

7-1. Configure Interface

Interface type	USB Device	USB 1.1 or 2.0, TypeA, female connector. Virtual COM Port(CP210x:Silicon Laboratories Inc)
	RS-232C	D-sub 9 pin, male connector.
	Settings	Baud rate: 115200/57600/38400/19200/ 9600. 8bit,Parity:None,Stop1bit,NoFlow Control.

Return to Local control mode

In order to switch back to the Local control mode (front panel operation), press the LOCAL key.

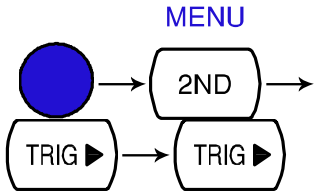


LOCAL

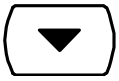
7-2. Configure USB interface

USB device port configuration

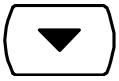
1. Press the Shift key, the 2ND (Menu) key, the Right key twice. The I/O configuration menu appears.



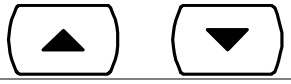
2. Press the Down key. The USB selection display appears.



3. Press the Down key. The USB ON/OFF selection appears.



4. Press the Up/Down key to select ON or OFF.



5. Press the ENTER key to confirm USB selection.

NOTE:
If USB is ON, RS-232C is disable.

ENTER

6. Press the Exit key to go back to the default display.

NOTE:
Can't communicate when menu is displayed.

7. Connect the USB cable to the rear panel terminal (upper port).

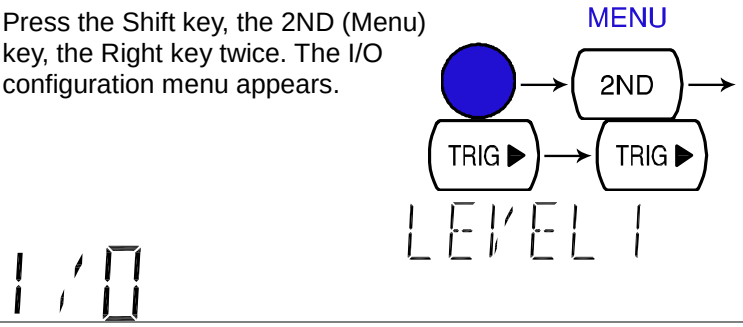
8. Please install the VCP driver in the VCP folder of the accessory CD (slabvcp.inf).

9. If you want to change the settings for baud rate, please be made in the settings of the RS232C interface first.

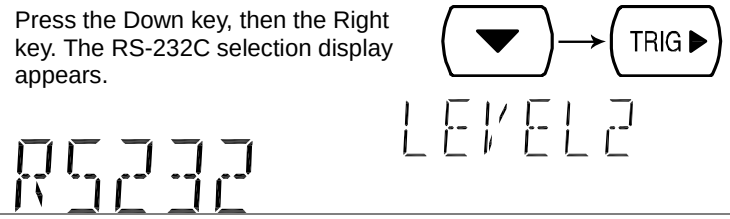
7-3. Configure RS-232C interface

Configuration step

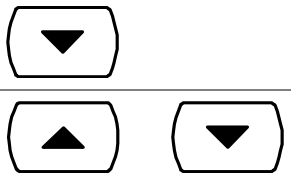
1. Press the Shift key, the 2ND (Menu) key, the Right key twice. The I/O configuration menu appears.



2. Press the Down key, then the Right key. The RS-232C selection display appears.

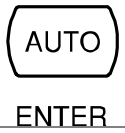


3. Press the Down key and down or up keys repeatedly to select the baud rate.



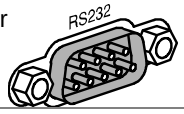
115200⇔57600⇔38400⇔19200⇔9600

4. Press the ENTER key to confirm RS-232C and baud rate selection.



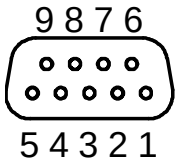
5. Press the Exit key to go back to the default display.
   Can't communicate when menu is displayed.

6. Connect the RS-232C cable to the rear panel terminal.



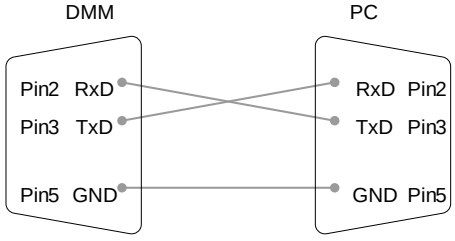
RS-232C pin assignment

Pin 2: RxD
Pin 3: TxD
Pin 5: GND
Pin 1, 4, 6 ~ 9: No Connection



PC – Connection

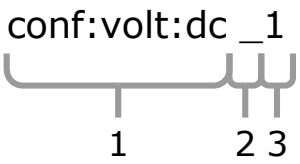
Null-modem connection, in which transmit (TxD) and receive (RxD) lines are cross-linked, is required.



7-4. Command Syntax

The commands are partially compatible with IEEE488.2 (1992) and SCPI (1994) standard. Commands are NON-case sensitive.

Example command



1: Command Header

2: Single space

3: Parameter

Parameter example	Boolean	Boolean logic: 0 or 1. Used for On (1) or Off (0) command.
	NR1	Integer: 0, 1, 2, 3.....
	NR2	Decimal number: 0.0, 0.1, 0.2,....
	NR3	Floating point number: 4.5e-1, 8.5e+1,...
	min, max	The DL-2052 automatically translates to Minimum (min) or Maximum (max) value available.
Automatic parameter range selection	The DL-2052 automatically translates the command parameter into the closest available value.	
	Example 1	conf:volt:dc_1 (Sets the measurement item to DC Voltage and the range to 1V). the DL-2052 selects the 1V range.
	Example 2	conf:volt:dc_2 (Sets the measurement item to DC Voltage and the range to 2V). There is no 2V range so the DL-2052 selects the closest range, 10V.
Query example	READ?	Respond measurements value
Message Terminator	Marks the end of a command line. The following messages are in accordance with IEEE488.2 standard.	
	Line feed code(0x0A) or Carriage Return(0x0D)	
Message Separator	; (semicolon)	Command separator.
Response Terminator	LF (0x0A), CR (0x0D) is added at the end of the response message.	

7-5. Command Set

- Commands are **non**-case sensitive.
- Underline means a single space (dc_1→DC 1V).
- When the parameter does not match the real value, the closest possible option is automatically selected (dc_2 [DC 2V range]→DC 10V)

7-5-1. CONFigure command

conf:volt:dc	Sets measurement to DC Voltage and specifies range. Parameter: NR2, min, max Example: conf:volt:dc_1 (DCV, 1V range) Example: conf:volt:dc_min (DCV, minimum range)
conf:volt:ac	Sets measurement to AC Voltage and specifies range. Parameter: NR2, min, max Example: conf:volt:ac_1 (ACV, 1V range) Example: conf:volt:ac_min (ACV, minimum range)
conf:volt:dcac	Sets measurement to DC+AC Voltage and specifies range. Parameter: NR2, min, max Example: conf:volt:dcac_1 (DC+ACV, 1V range) Example: conf:volt:dcac_min (DC+ACV, minimum range)
conf:curr:dc	Sets measurement to DC Current and specifies range. Parameter: NR2, min, max Example: conf:curr:dc_10e-3 (DCI, 10mA range) Example: conf:curr:dc_min (DCI, minimum range)
conf:curr:ac	Sets measurement to AC Current and specifies range. Parameter: NR2, min, max Example: conf:curr:ac_10e-2 (ACI, 100mA range) Example: conf:curr:ac_min (ACI, minimum range)
conf:curr:dcac	Sets measurement to DC+AC Current and specifies range. Parameter: NR2, min, max Example: conf:curr:dcac_10 (DC+ACI, 10A range) Example: conf:curr:dcac_min (DC+ACI, minimum range)
conf:res	Sets measurement to 2W Resistance and specifies range. Parameter: NR2, min, max Example: conf:res_10e3 (2W R, 10K range) Example: conf:res_min (2W R, minimum range)
conf:fres	Sets measurement to 4W Resistance and specifies range. Parameter: NR2, min, max Example: conf:fres_10e3 (4W R, 10K range) Example: conf:fres_min (4W R, minimum range)
conf:freq	Sets measurement to Frequency and specifies range.
conf:per	Sets measurement to Period and specifies range.
conf:cont	Sets measurement to Continuity.
conf:diod	Sets measurement to Diode.
conf:temp	Sets measurement to Temperature.
conf:stat:func?	Returns function of 1st display. Parameter: 1 (DCV), 2 (ACV), 3 (DCA-10A), 4 (ACA-10A), 5 (DCA-mA), 6 (ACA-mA), 7 (2WR), 8 (Freq), 9 (TempC), 10 (AC+DCA-10A), 11 (AC+DCV), 12 (AC+DCA-mA), 13 (Diode), 14 (Period), 15 (TempF), 16 (4WR), 17 (Cont.)
conf:stat:rang?	Returns range of 1st display. Parameter: DCV: 1 (100mV), 2 (1V), 3(10V), 4 (100V), 5 (1000V) ACV: 1 (100mV), 2 (1V), 3(10V), 4(100V), 5(750V) AC+DCV: 1 (100mV), 2 (1V), 3(10V), 4 (100V), 5 (1000V) DCmA, ACmA, ACmA+DCmA: 1(10mA), 2(100mA), 3(1A) 2WR, 4WR: 1(100Ω), 2(1kΩ), 3(10kΩ), 4(100kΩ), 5(1MΩ), 6(10MΩ), 7(100MΩ) DCA, ACA, AC+DCA (10A range): 1 (one range) Freq, TempC, TempF, Diode, Period, Cont.: 1 (one range)
conf:auto	Set 1st display to Auto range. Parameter: 0 (disable auto range), 1 (enable auto range)

conf:auto?	Return 1st display Auto range status. Parameter: 0 (disable auto range), 1 (enable auto range)

7-5-2. SENSe command

sens:det:rate	Sets detection rate. Parameter: s (slow), m (medium), f (fast) Example: sens:det:rate_s (set detection rate to Slow)
sens:det:rate?	Returns detection rate. Parameter: Slow, Mid, Fast
sens:temp:tco:type	Sets thermocouple type. Parameter: j (type J), k (type K), t (type T) Example: sens:temp:tco:type_j (set thermocouple type to J)
sens:temp:tco:type?	Returns thermocouple type. Parameter: J (type J), K (type K), T (type T)
sens:temp:rjun:sim	Set temperature simulation value. Parameter: NR2 Example: sens:temp:rjun:sim_23
sens:temp:rjun:sim?	Returns temperature simulation value.
sens:aver:tcon	Selects digital filter type. Parameter: mov (moving), rep (repeating) Example: sens:aver:tcon_mov (moving digital filter)
sens:aver:tcon?	Returns digital filter type. Parameter: MOV (moving), REP (repeating)
sens:aver:coun	Sets digital filter count. Parameter: 2 ~ 100 Example: sens:aver:coun_100 (filter count 100)
sens:aver:coun?	Returns current digital filter count. Parameter: 2 ~ 100
sens:aver:stat	Turns digital filter On/Off. Parameter: Boolean Example: sens:aver:stat_1 (digital filter On)
sens:aver:stat?	Returns digital filter status, On or Off. Parameter: Boolean

7-5-3. UNIT command

unit:temp	Selects temperature unit, celsius or fahrenheit. Parameter: c (celsius), f (fahrenheit) Example: unit:temp_c (temperature unit celsius)
unit:temp?	Returns temperature unit, celsius or fahrenheit. Parameter: C (celsius), F (fahrenheit)

7-5-4. CALCulate command

calc:func	Activates advanced measurement functions. Parameter: rel (relative), max (Max), hold (Hold), dbm (dBm), db(switches between dB, dB+dBV, and dB+dBm), math (Math), comp (Compare) Example: calc:func_math (activate math function) Example: calc:func_db (activate dB) calc:func_db (second issue activate dB+dBV(dBm)) calc:func_db (third issue activate dB+dBm(dBV))
calc:func?	Returns current advanced measurement functions. Parameter: rel (relative), max (Max), hold (Hold), dbm (dBm), DB-V (dB-dBV), DB-M (dB-dBm), math (Math), comp (Compare)
calc:stat	Turns math function On/Off. Parameter: Boolean Example: calc:stat_1 (math function On)
calc:stat?	Returns math function status, On or Off. Parameter: Boolean

calc:aver:min?	Returns minimum value stored.
calc:aver:max?	Returns maximum value stored.
calc:aver:aver?	Returns average value stored.
calc:aver:coun?	Returns number of data count.
calc:rel:ref	Sets reference value in Relative value measurement. Parameter: NR2, min, max Example: calc:rel:ref_1.0 (reference value set to 1.0)
calc:rel:ref?	Returns reference value in Relative value measurement. Parameter: NR2, min, max
calc:db:ref	Sets reference value in dB measurement. Parameter: NR2, min, max Example: calc:db:ref_1.0 (reference value set to 1.0)
calc:db:ref?	Returns reference value in dB measurement. Parameter: NR2, min, max
calc:dbm:ref	Sets reference value in dBm measurement. Parameter: NR2, min, max Example: calc:db:ref_1.0 (reference value set to 1.0)
calc:dbm:ref?	Returns reference value in dBm measurement. Parameter: NR2, min, max
calc:lim:low	Sets lower limit value in Compare measurement. Parameter: NR2, min, max Example: calc:lim:low_1.0 (lower limit set to 1.0)
calc:lim:low?	Returns lower limit value in Compare measurement. Parameter: NR2, min, max
calc:lim:upp	Sets upper limit value in Compare measurement. Parameter: NR2, min, max Example: calc:lim:low_1.0 (upper limit set to 1.0)
calc:lim:upp?	Returns upper limit value in Compare measurement. Parameter: NR2, min, max
calc:math:mmf	Sets factor(M) in Math measurement. Parameter: NR2 Example: calc:math:mmf_1.03 (Math factor set to 1.03)
calc:math:mmf?	Returns factor(M) in Math measurement. Parameter: NR2
calc:math:mbf	Sets offset(B) in Math measurement. Parameter: NR2 Example: calc:math:mbf_10 (Math offset set to 10)
calc:math:mbf?	Returns offset(B) in Math measurement. Parameter: NR2
calc:math:perc	Sets target value in Math measurement. Parameter: NR2 Example: calc:math:perc_50 (target set to 50)
calc:hold:ref	Set percentage of Hold function. Parameter: 0 to 99, min, max
calc:hold:ref?	Return percentage of Hold function. Parameter: 0 to 99

7-5-5. TRIGger command

read?	Returns 1st and 2nd display value.
val1?	Returns 1st display value.
val2?	Returns 2nd display value.

trig:sour	Selects trigger source. Parameter: int (internal), ext (external) Example: trig:sour_ext (External trigger selected)
trig:sour?	Returns current trigger source. Parameter: INT (internal), EXT (external)
trig:del	Sets trigger delay in milli-seconds. Parameter: 0 ~ 9999, min, max Example: trig:del_50 (trigger delay set at 50ms) Example: trig:del_min (trigger delay set at minimum 1ms)
trig:del?	Returns trigger delay in milli-seconds. Parameter: 0 ~ 9999, min, max
trig:auto	Turns trigger auto mode On or Off. Parameter: 1 (on), 0 (off) Example: trig:auto_1 (trigger auto mode On)
trig:auto?	Returns current trigger auto mode. Parameter: 1 (on), 0 (off)
samp:coun	Sets number of sampling. Parameter: NR1 (1 to 127) Example: samp:coun_10 (sampling set at 10)
samp:coun?	Returns number of sampling. Parameter: NR1 (1 to 127)
trig:coun	Sets number of trigger counting. Parameter: NR1 (1 to 127) Example: trig:coun_100 (trigger count set at 100)
trig:coun?	Returns number of trigger count. Parameter: NR1 (1 to 127)
trac:data?	Returns buffer contents.
trac:cle	Clears buffer contents.

7-5-6. SYStem related command

syst:disp	Turns display On or Off. Parameter: Boolean Example: disp_1 (display On)
syst:disp?	Returns display status, On of Off. Parameter: Boolean
syst:beep:stat	Select beep mode. Parameter: 0 (Off), 1 (Pass), 2 (Fail) Example: syst:beep:stat_1 (Beep when pass)
syst:beep:stat?	Returns beep mode status. Parameter: No beep, Beep on Pass, Beep on Fail
syst:err?	Returns current system error, if there is any.
syst:vers?	Returns system version. Parameter: 1.00 ~
*rst	Reset system.
*idn?	Returns company name, model No., and system version. Example: TEXIO, DL-2052, 1.0

7-5-7. STAtus reporting command

stat:ques:enab — Enable bits in the Questionable Data register.

Value	Bit	EVENT
4096	12	Limit Test Fail Hi
2048	11	Limit Test Fail Lo
512	9	Ohms Overload
2	1	Current Overload
1	0	Voltage Overload

stat:ques:enab?	Returns Questionable Data register contents in decimal number.
stat:ques:even?	Returns Questionable Data event register contents in decimal number.
stat:pres	Clear Questionable Data enable register.

7-5-8. RS-232C interface command

syst:loc	Enables front panel control and disables remote control
syst:rem	Enables remote control and disables front panel control

7-5-9. IEEE 488.2 common command

*cls — Clears event status register (Output Queue, Operation Event Status, Questionable Event Status, Standard Event Status)

*ese? — Returns ESER (Event Status Enable Register) contents.
Example: 130 means ESER=10000010

value	Bit	EVENT
128	7	POWER ON
32	5	Command Error
16	4	Execute Error
8	3	Device Error
4	2	Query Error
1	0	Execute Complete

*ese <0~255> — Sets ESER contents.
Example: *ese 65 sets ESER to 01000001

*esr? — Returns and clears SESR (Standard Event Status Register).
Example: 198 means SESR=11000110

value	Bit	EVENT
128	7	POWER ON
32	5	Command Error
16	4	Execute Error
8	3	Device Error
4	2	Query Error
1	0	Execute Complete

*idn? — Returns company name, model No., and system version.
Example: TEXIO, DL-2052, 1.0

*opc? — “1” is placed in the output queue when all the pending operations are completed.

*opc — Sets operation complete bit (bit0) in SERS (Standard Event Status Register) when all pending operations are completed.

*psc? — Returns power On clear status.
Parameter: 0 (cleared), 1 (not cleared)

*psc — Clears power On status.
Parameter: 0 (clear), 1 (don’t clear)

*rst — Recalls default panel setup (reset the device).

*sre? — Returns SRER (Service Request Enable Register) contents.
Example: 3 means SRER=00000011

Value	Bit	Event
64	6	Service Request
32	5	Standard Event
16	4	Message Available
8	3	Questionable Data

*sre <0~255> — Sets SRER contents.
Example: *SRE 7 SRER=00000111

*stb?	Returns SBR (Status Byte Register) contents. Example: 81 means SBR=01010001

Value	Bit	Event
64	6	Service Request
32	5	Standard Event
16	4	Message Available
8	3	Questionable Data

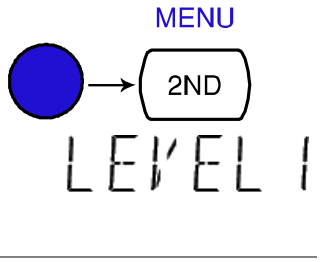
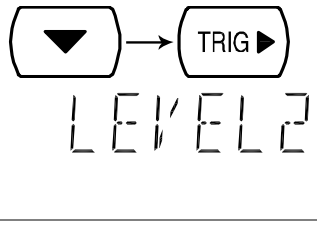
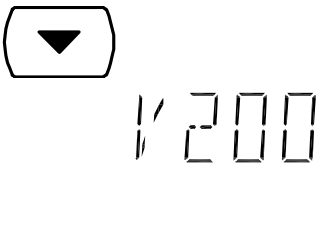
*trg	Manually triggers the DL-2052.

7-5-10. Secondary display: CONFigure2 command

conf2:volt:dc	Configure 2nd display to DC Voltage. Parameter: NR2, min, max Example: conf2:volt:dc_1 (DC Voltage, 1V range)
conf2:volt:ac	Configure 2nd display to AC Voltage. Parameter: NR2, min, max Example: conf2:volt:ac_1 (AC Voltage, 1V range)
conf2:curr:dc	Configure 2nd display to DC Current. Parameter: NR2, min, max Example: conf2:curr:dc_10e-3 (DC Current, 10mA range)
conf2:curr:ac	Configure 2nd display to AC Current. Parameter: NR2, min, max Example: conf2:curr:ac_10e-3 (AC Current, 10mA range)
conf2:res	Configure 2nd display to 2W Resistance. Parameter: NR2, min, max Example: conf2:res_10e2 (2W Resistance, 1kΩ range)
conf2:fres	Configure 2nd display to 4W Resistance. Parameter: NR2, min, max Example: conf2:fres_10e2 (Resistance, 1kΩ range)
conf2:freq	Configure 2nd display to Frequency.
conf2:per	Configure 2nd display to Period.
conf2:temp	Configure 2nd display to Temperature.
conf2:off	Turn off the dual display mode (2nd display is off)
conf2:stat:func?	Returns function of 2nd display. Parameter: 1 (DCV), 2 (ACV), 3 (DCA-10A), 4 (ACA-10A), 5 (DCA-mA), 6 (ACA-mA), 7 (2WR), 8 (Freq), 9 (TempC), 10 (AC+DCA-10A), 11 (AC+DCV), 12 (AC+DCA-mA), 13 (Diode), 14 (Period), 15 (TempF), 16 (4WR), 17 (Cont.)
conf2:stat:rang?	Returns range of 2nd display. Parameter: DCV: 1 (100mV), 2 (1V), 3(10V), 4 (100V), 5 (1000V) ACV: 1 (100mV), 2 (1V), 3(10V), 4(100V), 5(750V) AC+DCV: 1 (100mV), 2 (1V), 3(10V), 4 (100V), 5 (1000V) DCA, ACA, AC+DCA: 1(10mA), 2(100mA), 3(1A) 2WR, 4WR: 1(100Ω), 2(1kΩ), 3(10kΩ), 4(100kΩ), 5(1MΩ), 6(10MΩ), 7(100MΩ) DCA, ACA, AC+DCA (10A range): 1 (one range) Freq, TempC, TempF, Diode, Period, Cont.: 1 (one range)
conf2:auto	Set 2nd display to Auto range. Parameter: 0 (disable auto range), 1 (enable auto range)
conf2:auto?	Return 2nd display Auto range status. Parameter: 0 (disable auto range), 1 (enable auto range)

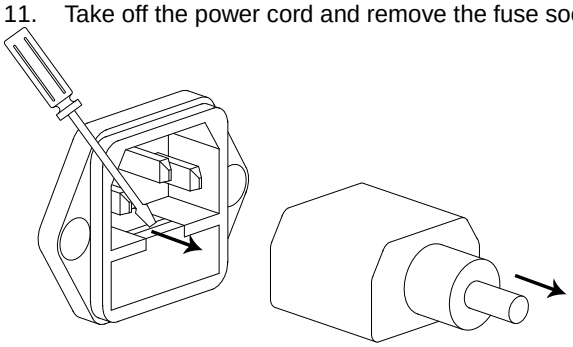
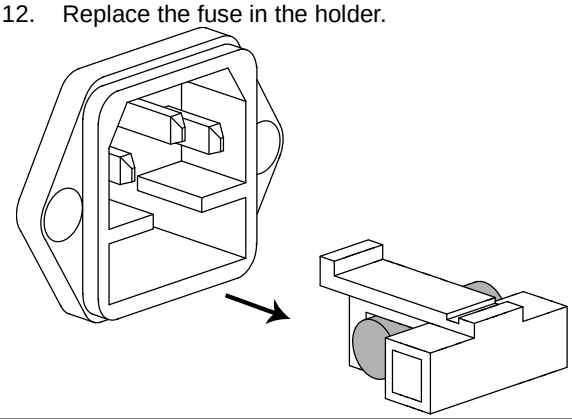
8. APPENDIX

8-1. Firmware Version

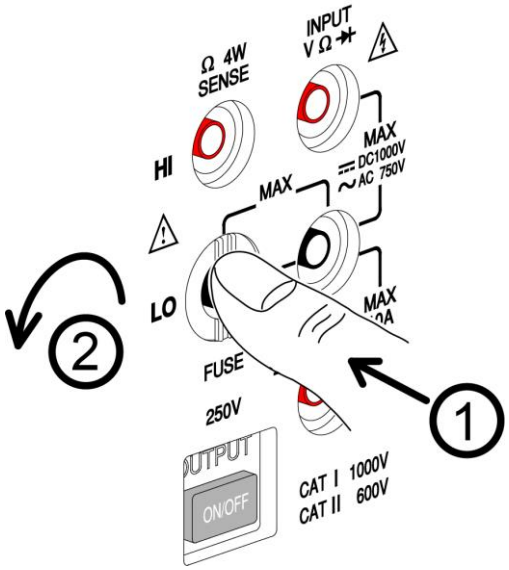
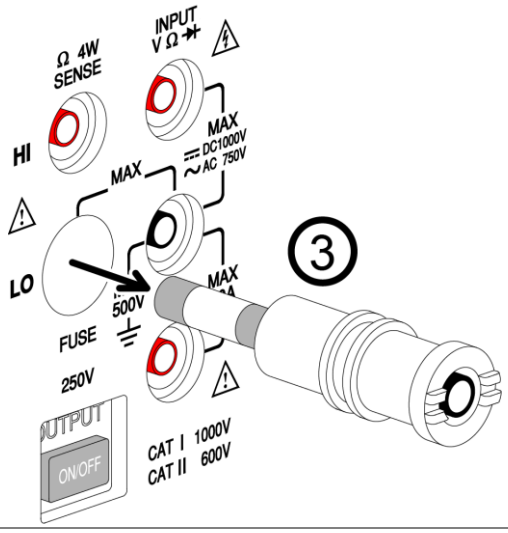
Background	Firmware version is available for viewing system information.	
	Firmware version	Shows the DL-2052 firmware version number.
View firmware version	7. Press the Shift key followed by the 2ND (Menu) key. The system menu appears.	
	8. Press the Down key followed by the Right key. The firmware version menu appears.	
	9. Press the Down key. The firmware version appears.	
	10. Press the Exit key to go back to the default display.	

8-2. Fuse Replacement

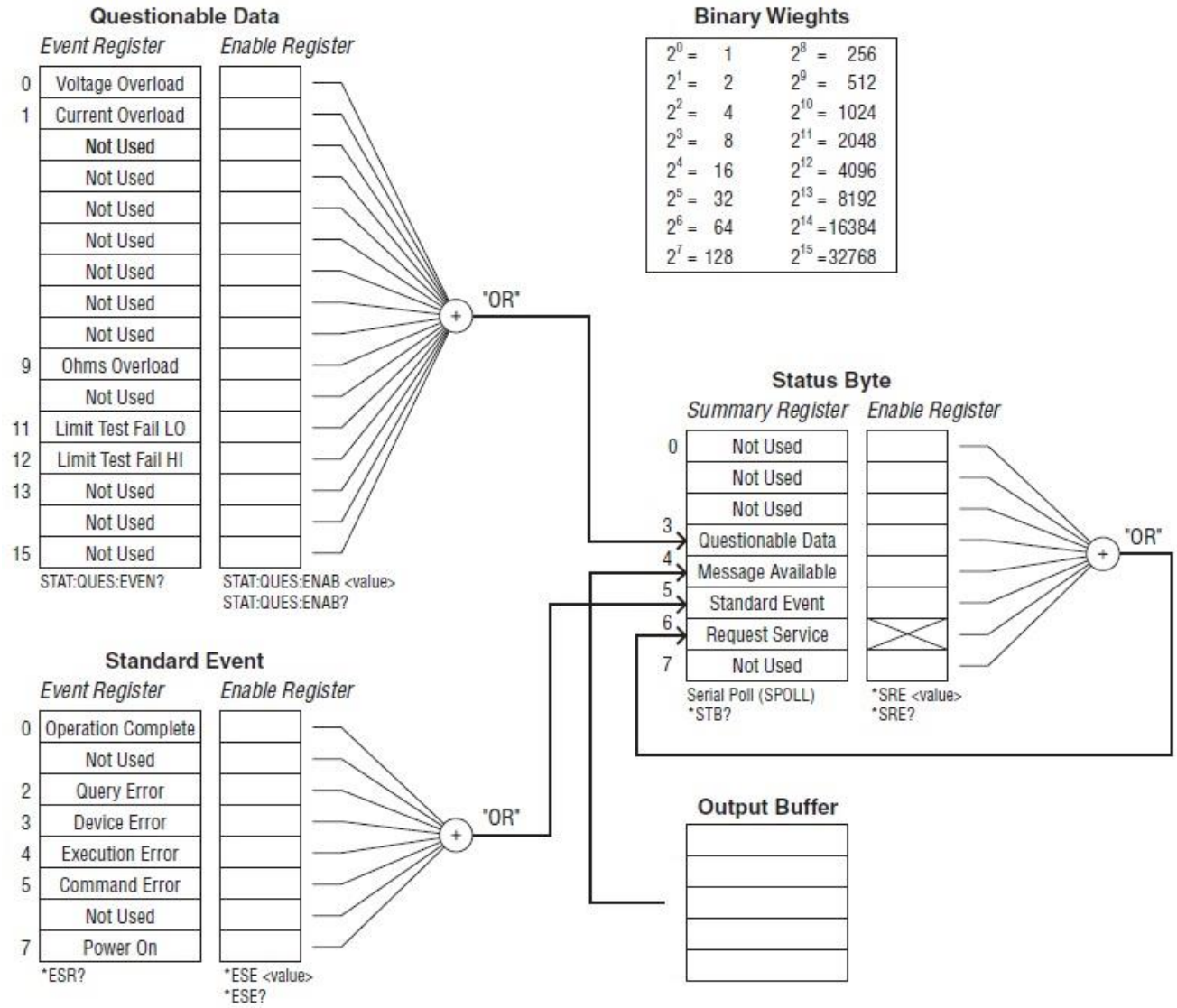
8-2-1. Replace AC source fuse

Step	11. Take off the power cord and remove the fuse socket using a minus driver.	
	12. Replace the fuse in the holder.	
Rating	T3.15A, 250V	

8-2-2. Replace input current fuse

Step	
	13. Press the Fuse holder. 
	14. The fuse holder comes out. Replace the fuse inserted at the end of the holder. 
Rating	T2A, 250V

8-3. Status system



9. Specifications

9-1. General


Note

- All specifications are ensured only under a single display.
- At least 30 minutes of warm-up time is required before applying these specifications.
- Make sure the power ground is connected.

Resolution	Type	Digit
	Slow (S)	5 1/2 Digit (119999 count)
	Medium (M)	4 1/2 Digit
	Fast (F)	3 1/2 Digit
Operation Environment	Ambient Temperature 0°C ~ 40°C, Relative Humidity < 75% (For full accuracy: 18°C ~ 28°C)	
Temperature Coefficient	< 0.2 x applicable accuracy per degree (°C) (for 0°C ~ 18°C and 28°C ~ 40°C)	
Storage Environment	Ambient Temperature −10°C ~ 70°C Relative Humidity: 0°C ~ 35°C < 75%, 35°C ~ 50°C < 50%	
Power Source	AC 100–240V ± 10%, 50–60Hz	
Dimension	265(W) x 107(H) x 350(D) mm	
Weight	Approx. 2.6kg without option	

9-2. Reading rates (readings/sec)

Function	Rate		
	S	M	F
DCV	10	30	60
DCI	10	30	60
ACV	1	5	20
ACI	1	5	20
2/4WΩ (10M/100MΩ)	1	1.5	2
2/4WΩ (others)	3	5	8
ACV+DCV	0.5	1	3
ACI+DCI	0.5	1	3
Diode	30	30	60

9-3. DC Voltage


Note

- Max. Input: 1000V DC or Peak on all range

Rate	Range	Resolution	Full Scale	Accuracy	Input Impedance
S	100.000mV	1µV	120.000mV	0.012%+8	10MΩ
	1.00000V	10µV	1.20000V	0.012%+5	
	10.0000V	100µV	12.0000V	0.012%+5	
	100.000V	1mV	120.000V	0.012%+5	
	1000.00V	10mV	1000.00V	0.012%+5	
M	100.00mV	10µV	120.00mV	0.012%+5	
	1.0000V	100µV	1.2000V	0.012%+5	
	10.000V	1mV	12.000V	0.012%+5	
	100.00V	10mV	120.00V	0.012%+5	
	1000.0V	100mV	1000.0V	0.012%+5	
F	100.0mV	100µV	120.0mV	0.012%+2	
	1.000V	1mV	1.200V	0.012%+2	
	10.00V	10mV	12.00V	0.012%+2	
	100.0V	100mV	120.0V	0.012%+2	
	1000V	1V	1000V	0.012%+2	

9-4. AC Voltage


Note

- The specifications are only applicable for sinusoidal signals with amplitudes greater than 5% of the Full Scale reading, excluding the DL-2052 which must have amplitudes greater than 10.0mV when using a range of 100.000mV.
- (*) Input > 450V only for 30sec, < 200V for 20 ~ 45Hz

Rate	Range	Resolution	Full Scale	Input Impedance
S	100.000mV	1µV	120.000mV	1.1MΩ in parallel with approx.100pF
	1.00000V	10µV	1.20000V	
	10.0000V	100µV	12.0000V	
	100.000V	1mV	120.000V	
	750.00V(*)	10mV	750.00V	
M	100.00mV	10µV	120.00mV	
	1.0000V	100µV	1.2000V	
	10.000V	1mV	12.000V	
	100.00V	10mV	120.00V	
	750.0V(*)	100mV	750.0V	
F	100.0mV	100µV	120.0mV	
	1.000V	1mV	1.200V	
	10.00V	10mV	12.00V	
	100.0V	100mV	120.0V	
	750V(*)	1V	750V	

Rate	Range	Accuracy (reading%+digits)		
		20~45Hz	45~10kHz	10k~30kHz
S	100.000mV	1% + 100	0.2% + 100	1.5% + 300
	1.00000V	1% + 100	0.2% + 100	1% + 100
	10.0000V	1% + 100	0.2% + 100	1% + 100
	100.000V	1% + 100	0.2% + 100	1% + 100
	750.00V(*)	1% + 100	0.2% + 100	1% + 100
M	100.00mV	—	0.2% + 40	1.5% + 80
	1.0000V	—	0.2% + 40	1% + 40
	10.000V	—	0.2% + 40	1% + 40
	100.00V	—	0.2% + 40	1% + 40
	750.0V(*)	—	0.2% + 40	1% + 40
F	100.0mV	—	0.2% + 5	1.5% + 10
	1.000V	—	0.2% + 5	1% + 5
	10.00V	—	0.2% + 5	1% + 5
	100.0V	—	0.2% + 5	1% + 5
	750V(*)	—	0.2% + 5	1% + 5

9-5. DC Current


Note

- mA range protected with a 2A fuse
- 10A range protected with a 12A, 600V fuse
- 10A only for 30 seconds

Rate	Range	Resolution	Full Scale	Accuracy (reading%+ digits)
S	10.0000mA	0.1µA	12.0000mA	0.05%+15
	100.000mA	1µA	120.000mA	0.05%+5
	1.0000A	100µA	1.2000A	0.2%+5
	10.0000A	100µA	10.0000A	0.2%+5
M	10.000mA	1µA	12.000mA	0.1%+6
	100.00mA	10µA	120.00mA	0.1%+3
	1.000A	1mA	1.200A	0.2%+3
	10.000A	1mA	10.000A	0.2%+3
F	10.00mA	10µA	12.00mA	0.1%+2
	100.0mA	100µA	120.0mA	0.1%+2
	1.00A	10mA	1.20A	0.2%+2
	10.00A	10mA	10.00A	0.2%+2

9-6. AC Current


Note

- The specifications are only applicable for sinusoidal signals with amplitudes greater than 5% of the Full Scale reading, excluding the DL-2052 which must have amplitudes greater than 1.0mA when using a range of 10.0000mA.
- mA range protected with a 2A fuse
- 10A range protected with a 12A, 600V fuse
- 10mA/100mA range specifications are verified for < 10kHz
- 1A/10A range specifications are verified for < 5kHz

Rate	Range	Resolution	Full Scale
S	10.0000mA	0.1μA	12.0000mA
	100.000mA	1μA	120.000mA
	1.0000A	100μA	1.2000A
	10.0000A	100μA	10.0000A
M	10.000mA	1μA	12.000mA
	100.00mA	10μA	120.00mA
	1.000A	1mA	1.200A
	10.000A	1mA	10.000A
F	10.00mA	10μA	12.00mA
	100.0mA	100μA	120.0mA
	1.00A	10mA	1.20A
	10.00A	10mA	10.00A

Accuracy (reading%+digits)

Rate	Range	20 ~ 50Hz	50 ~ 10kHz
S	10.0000mA	1.5% + 100	0.5% + 100
	100.000mA	1.5% + 100	0.5% + 100
	1.0000A	—	1% + 100
	10.0000A	—	1% + 100
M	10.000mA	—	0.5% + 40
	100.00mA	—	0.5% + 12
	1.000A	—	—
	10.000A	—	—
F	10.00mA	—	0.5% + 5
	100.0mA	—	0.5% + 2
	1.00A	—	—
	10.00A	—	—

9-7. 2W Resistance


Note

- Max. Input: 500V DC or 500V rms AC
- *: Relative mode

Rate	Range	Full Scale	Accuracy reading%+digits
S	100.000Ω	120.000Ω	0.1% + 8*
	1.00000kΩ	1.20000kΩ	0.08% + 5*
	10.0000kΩ	12.0000kΩ	0.06% + 5*
	100.000kΩ	120.000kΩ	0.06% + 5
	1.00000MΩ	1.20000MΩ	0.06% + 5
	10.0000MΩ	12.0000MΩ	0.3% + 5
	100.000MΩ	120.000MΩ	3.0% + 8
M	100.00Ω	120.00Ω	0.1% + 5*
	1.0000kΩ	1.2000kΩ	0.08% + 3*
	10.000kΩ	12.000kΩ	0.06% + 3
	100.00kΩ	120.00kΩ	0.06% + 3
	1.0000MΩ	1.2000MΩ	0.06% + 3
	10.000MΩ	12.000MΩ	1.5% + 3
	100.00MΩ	120.00MΩ	5.0% + 5
F	100.0Ω	120.0Ω	0.1% + 2*
	1.000kΩ	1.200kΩ	0.08% + 2
	10.00kΩ	12.00kΩ	0.06% + 2
	100.0kΩ	120.0kΩ	0.06% + 2
	1.000MΩ	1.200MΩ	0.06% + 2
	10.00MΩ	12.00MΩ	1.5% + 2
	100.0MΩ	120.0MΩ	5.0% + 2

9-8. 4W Resistance


Note

- Max. Input: 500V DC or 500V rms AC

Rate	Range	Full Scale	Accuracy reading%+digits
S	100.000Ω	120.000Ω	0.05% + 8
	1.00000kΩ	1.20000kΩ	0.05% + 5
	10.0000kΩ	12.0000kΩ	0.05% + 5
	100.000kΩ	120.000kΩ	0.05% + 5
	1.00000MΩ	1.20000MΩ	0.05% + 5
	10.0000MΩ	12.0000MΩ	0.3% + 5
	100.000MΩ	120.000MΩ	3.0% + 8
M	100.00Ω	120.00Ω	0.05% + 5
	1.0000kΩ	1.2000kΩ	0.05% + 3
	10.000kΩ	12.000kΩ	0.05% + 3
	100.00kΩ	120.00kΩ	0.05% + 3
	1.0000MΩ	1.2000MΩ	0.05% + 3
	10.000MΩ	12.000MΩ	1.5% + 3
	100.00MΩ	120.00MΩ	5.0% + 5
F	100.0Ω	120.0Ω	0.05% + 2
	1.000kΩ	1.200kΩ	0.05% + 2
	10.00kΩ	12.00kΩ	0.05% + 2
	100.0kΩ	120.0kΩ	0.05% + 2
	1.000MΩ	1.200MΩ	0.05% + 2
	10.00MΩ	12.00MΩ	1.5% + 2
	100.0MΩ	120.0MΩ	5.0% + 2

9-9. Diode/Continuity


Note

- Max. Input: 500V DC or 500V rms AC

Item	Range
Diode	Approx. 2V, 0.5mA
Continuity	1 ~ 1000Ω

9-10. Frequency


Note

- Max. Input: 750V rms or 1000V peak

Frequency	Sensitivity	Accuracy (reading%+digits)
10Hz ~ 100kHz	0.1V	0.05% + 15
100kHz ~ 600kHz	1V	0.05% + 3
600kHz ~ 800kHz	2.5V	0.05% + 3

9-11. Temperature


Note

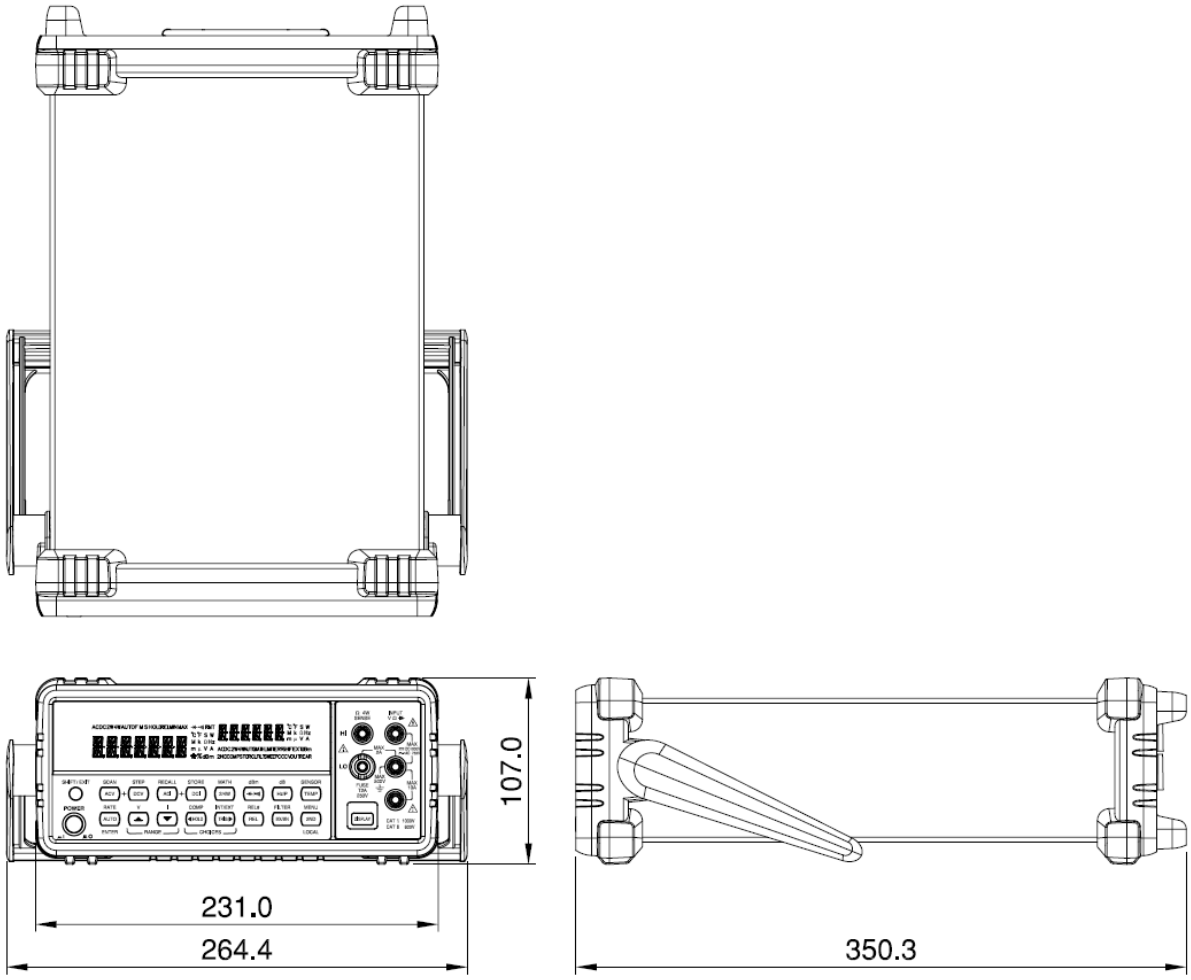
- Sensor errors excluded from Temperature specifications

	Type	Measurement Range
Thermo Couple	K	0 ~ +300°C
	T	0 ~ +300°C
	J	0 ~ +300°C
Resolution	0.01°C (0 ~ 300°C)	

9-12. Accessories

Accessories CD-ROM	**Instruction**
CAL KEY	**GDM-01**
Test leads	**GTL-107 or GTL-207**

9-13. External Dimensions Figure



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