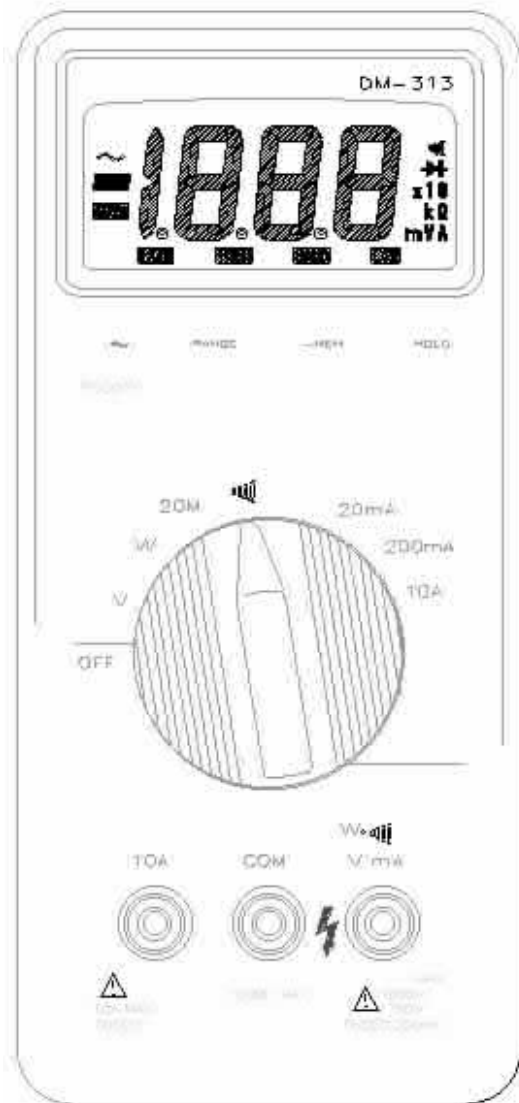


Adjustment and Test procedure Manual
for digital multimeter
Model : DM-313



LG Precision Co., Ltd.

1999/9/1

P/N:

Revision History

[illegible]

General Specifications of DM-313

Display: 3½ Digit Multimeter**Battery Life:** Typical 200 hours**Operating Temperature:** 0°C ~ 40°C (≤ 80% RH)**Storage temperature:** -10°C ~ 60°C (≤ 70% RH)**Accuracy guaranteed temperature:** 23°C ± 5°C (≤ 80% RH)**Maximum Reading Rate:** 2 readings / second

Explanation of each part of DM-313

① **LCD Display**① **Rotary S/W**

Used for selecting mode and range.

① **Terminal Ω-V-mA**

voltage, resistor and current measure terminal

① **Terminal COM**

Used for common terminal

① **Terminal 10A**

Used for measuring DC/AC current below 10A

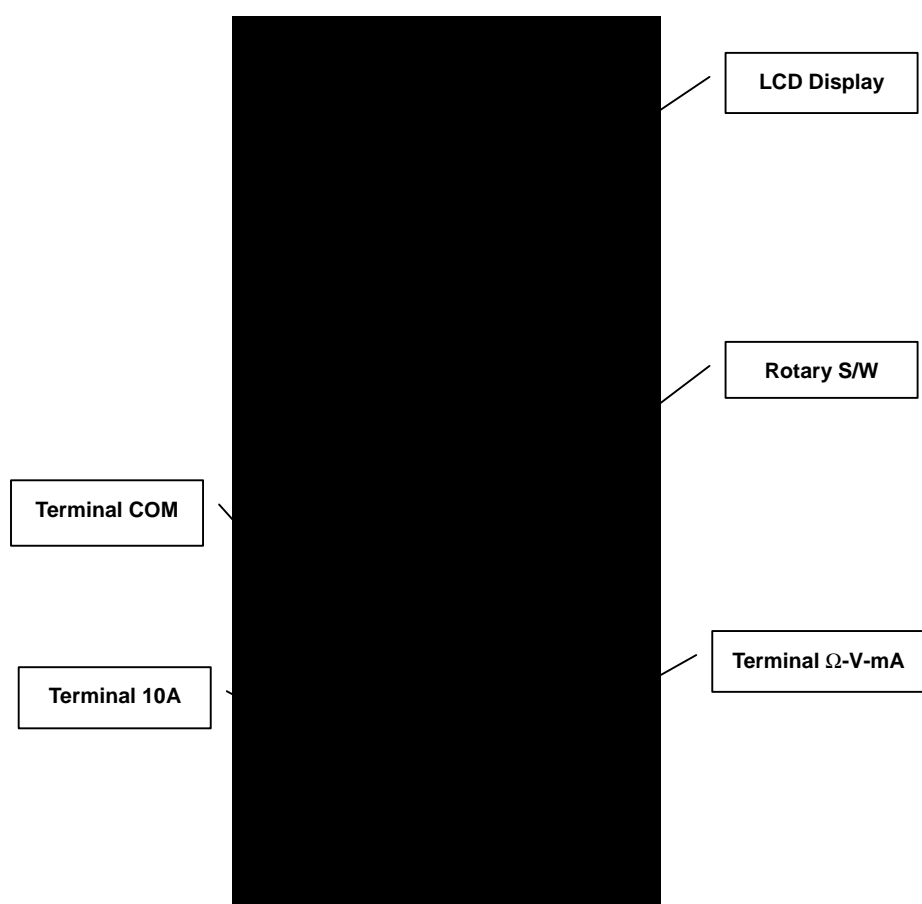


Fig 1 - Front View of DM-313

**Note**

Adjustment and Test of DM-313 should be conducted under proper test environment.

Check temperature and relative humidity before adjustment and test.

Accuracy guaranteed temperature: 23°C ± 5°C (Below 80% RH)

I Test Equipment List

DMM Calibrator: 1set
Decade Resistor: 1 set
DC Power Supply (0 ~ 12V DC) or 9V Battery

I Calibration Procedure

1. Power On Test

Turn DM-313 on by using rotary S/W. and check beep sound and LCD display.

2. LCD Display Test

Check LCD Display to each mode. Below chart shows correct display

Push AC/DC selection button to change to AC or DC.

Function	LCD Display to each range
DC VOLTAGE	00.0mV
AC VOLTAGE	.000 V
DC CURRENT	0.00mA → 00.0mA → 0.00A
AC CURRENT	0.00mA → 00.0mA → 0.00A
RESISTANCE	1000KΩ
RESISTANCE 20MΩ	1000KΩ X 10
CONTINUITY	1000KΩ
DIODE	OL V

3. HOLD Test

Check LCD display is at hold state when HOLD button is pushed.

4. Range Selection Test

Check range is changed when Range button is pushed.

5. MEM function Test

MEM function is used for probe compensation in measuring resistor. Buzzer sound is not generated in MEM function mode.

Factory Specification	Procedure
Short : 00.0 Open : 100.0	1. Set DM-313 to resistor measurement mode & Range 200 Ω . 2. Short-circuit between terminal COM and terminal V and push MEM button. 3. Open-circuit between terminal COM and terminal V.

6. Warning System

Factory Specification	Procedure
Beep Sound is generated	1. Set DM-313 DC current 10A mode or AC current 10A mode 2. Insert test probe to terminal COM and terminal 10A 3. Set DM-313 to other range
Probe is not inserted	1. Set DM-313 to other range except DC current 10A mode or AC current 10A mode 2. Insert test probe to terminal COM and terminal 10A

7. Low Battery Warning Display Test

Check a message, "BATT" on LCD display when Power supply or Battery Voltage goes below 6.4V.

8. Adjustment of DC voltage, AC voltage and DC current.

Item	Adjustment Specification	Procedure
DC Voltage	189.8 ~ 190.2	<ol style="list-style-type: none"> 1. Set Rotary S/W to DC Voltage mode. 2. Apply DC 190mV to Terminal COM and Terminal V of DM-313 with a calibrator 3. Adjust VR2 to be displayed 190.0mV on LCD display
AC Voltage	1.895 ~ 1.905	<ol style="list-style-type: none"> 1. Set Rotary S/W to AC Voltage mode 2. Apply AC 1.9V/60Hz to Terminal COM and Terminal V with a calibrator 3. Adjust VR1 to be displayed 190.0mV on LCD display
DC Current	9.95 ~ 10.05	<ol style="list-style-type: none"> 1. Set Rotary S/W to DC Current 10A Mode 2. Apply DC 10A current to terminal COM and Terminal 10A with a calibrator 3. Adjust MN Wire to be displayed 10.00A on LCD display with a ripper

9. Test

9-1 No Input on DC Voltage Mode

- n Specification : $\pm 0.1.0\text{mV}$
- n Set Rotary S/W to DC Voltage mode and check DM-313 to meet the above specification.

9-2 Short-circuit on DC Voltage Mode

- n Specification : $\pm 00.2 \text{ mV}$
- n Set Rotary S/W to DC Voltage mode and Short-circuit between terminal COM and terminal V
- n Check DM-313 to meet the above specification.

9-3 DC Voltage Measurement Test

Set Rotary S/W to DC Voltage Mode and Apply below voltage to terminal COM and terminal V to each range with a calibrator. Use range button to change DC voltage range.

Range	Customer Specification	Factory Specification	Test DC Voltage
DC 200mV	$\pm(0.5\% + 2\text{dgt})$	$\pm(0.4\% + 2\text{dgt})$	190mV
DC 2V			1.9V
DC 20V			19V
DC 200V			190V
DC 1000V			1000V

9-4 AC Voltage Measurement Test

Set Rotary S/W to AC Voltage Mode and Apply below voltage to terminal COM and terminal V to each range with a calibrator. Check the measurement value to each frequency, 60Hz and 400Hz.

Use range button to change AC voltage range

Range	Customer Specification	Factory Specification	Test AC Voltage
AC 2V	$\pm(0.75\%+5\text{dgt})$	$\pm(0.65\%+5\text{dgt})$	1.9V/60Hz 1.9V/400Hz
AC 20V			19V/60Hz 19V/400Hz
AC 200V			190V/60Hz 190V/400Hz
AC 750V			750V/60Hz 750V/400Hz

9-5 DC Current Measurement Test

Set Rotary S/W to DC Current 20mA range or DC Current 200mA range. Apply below DC current to terminal COM and terminal mA to each range with a calibrator. Check the measurement value to each range

Range	Customer Specification	Factory Specification	Test DC Current
DC 20mA	$\pm(0.75\%+2\text{dgt})$	$\pm(0.65\%+2\text{dgt})$	19mA
DC 200mA			190mA



Apply below DC current to **terminal COM and terminal 10A** with a calibrator.

Range	Customer Specification	Factory Specification	Test DC Current
DC 10A	$\pm(1.5\%+5\text{dgt})$	$\pm(1.4\%+5\text{dgt})$	9A

9-6 AC Current Measurement Test

Set Rotary S/W to AC Current 20mA range or AC Current 200mA. Apply below AC current to terminal COM and terminal mA to each range with a calibrator. Check the measurement value to each range

Range	Customer Specification	Factory Specification	Test AC Current
AC 20mA	$\pm(1.0\%+5\text{dgt})$	$\pm(0.9\%+5\text{dgt})$	19mA/60Hz 19mA/400Hz
AC 200mA			190mA/60Hz 190mA/400Hz



Apply below AC current **between terminal COM and terminal 10A** with a calibrator.

Range	Customer Specification	Factory Specification	Test AC Current
AC 10A	$\pm(2.0\%+7\text{dgt})$	$\pm(1.9\%+7\text{dgt})$	9A/60Hz 9A/400Hz

9-7 Resistance Measurement Test

Set Rotary S/W to Resistance Measure Mode and Apply below resistance value to terminal COM and terminal V to each range with decade resistor. Check the measurement value to each range.

Use range button to change range.

Range	Customer Specification	Factory Specification	Test Resistance value
200Ω	±(0.75%+1dgt)	±(0.65%+1dgt)	190Ω
2kΩ			1.9kΩ
20kΩ			19kΩ
200kΩ			190kΩ
2MΩ			1.9MΩ
20MΩ	±(1.0%+1dgt)	±(0.9%+1dgt)	10MΩ

9-8 Diode & Continuity Test

Set Rotary S/W to diode test mode and apply a diode between terminal COM and terminal V with forward direction.

Range	Factory Specification
Diode	Forward Direction : 0.450 ≤ Reverse Direction : OL V

Set Rotary S/W to continuity test mode and Short-circuit between terminal COM and terminal V.
Buzzer will sound when measurement is lower than 20Ω.

Range	Factory Specification
Continuity	Open Circuit : 1000kΩ Short Circuit : less than ≤ 00.3Ω

9-9 Short-circuit ohm Test

Set Rotary S/W to Resistance measure mode and short-circuit between terminal COM and terminal V

Range	Customer Specification	Factory Specification
200Ω		Less than 0.4Ω

Appendix A) Bill of material

LGP P/N	Category	Specification	PCB F/N	Quantity
334-013-1	BUSHING	INPUT CORE BLACK DMM		1
334-013-2	BUSHING	INPUT CORE RED DMM		2
362-035	SPRING	SHIELD SPRING DMM	SP1	1
384-017-1	HOLDER	BAT SNAP 9V UL		1
418-101	FILM VINYL	PPI255 W=60.0 DMM A MASKING		1
513-558R5	PCB BARE B/D	DM-313 PCB REV 5		1
521-131	SWITCH	PUSH S.W PS-2216A-L NS		1
563-063-2	FUSE	250V 0.25A 50F UL&EU	F1	1
563-065	FUSE	250V 10A H216010 ULE14080	F2	1
563-068	FUSE	125V 1A 22NM MICRO 101L	F3	1
564-015	FUSE HOLDER	FUSE HOLDER FC51A(DMM)		4
571-319	VARIABLE RESISTOR	VR TMC3K 1K (SMD)	VR2	1
571-320	VARIABLE RESISTOR	VR TMC3K 2K (SMD)	VR1	1
573-121	RESISTOR	W.W 0.99 OHM 1W 0.25%	R19	1
573-131	RESISTOR	M.G 14.746M 1/2W -0.2/0.05%	R09	1
573-132	RESISTOR	M.G 1.6385M 1/2W -0.2/0.05%	R10	1
573-133	RESISTOR	M.F 163.85K 1/4W -0.2/0.05%	R11	1
573-134	RESISTER	M.F 16.385K 1/4W -0.2/0.05%	R12	1
573-135	RESISTOR	M.F 1.6385K 1/4W -0.2/0.05%	R13	1
573-136	RESISTOR	M.F 163.85 1/4W -0.2/0.05%	R14	1
573-137	RESISTOR	M.G 10 MOHM 1/2W -0.2/0.05%	R17	1
573-138	RESISTOR	M.G 1.11MOHM 1/2W -0.2/0.05%	R22	1
573-139	RESISTOR	M.F 101 KOHM 1/4W -0.2/0.05%	R23	1
573-140	RESISTOR	M.F 10 KOHM 1/4W -0.2/0.05%	R24	1
573-141	RESISTOR	M.F 1 KOHM 1/4W -0.2/0.05%	R25	1
574-052-2	PTC	PT05MP-L1K6001	R07	1
574-052-2	PTC	PT05MP-L1K6001	R15	1
574-052-2	PTC	PT05MP-L1K6001	R7A	1
574-055	SPARK GAP	AG15PC 152FS-K2M DAIYOYDEN	SG1	1
581-162	CAPACITOR	ELEC 1UF 50V SRE-TYPE	C06	1
581-162	CAPACITOR	ELEC 1UF 50V SRE-TYPE	C07	1
581-176	CAPACITOR	ELEC 10UF 16V SRE-TYPE	C12,C14	2
581-195	CAPACITOR	MP 0.1UF 63V J MMY168	C03	1
581-195	CAPACITOR	MP 0.1UF 63V J MMY168	C08	1
581-195	CAPACITOR	MP 0.1UF 63V J MMY168	C09	1
581-195	CAPACITOR	MP 0.1UF 63V J MMY168	C11	1
585-154-1	DIODE	RL105	D1	1
585-154-1	DIODE	RL105	D2,D6,D7	3
585-248	DIODE	KDS226 (SMD) KEC	D3	1
585-262	DIODE	KDS184 (SMD)	D4,D5	2
591-647-2	IC	MC74HC00AD (SMD) MOTOROLA	U2	1
591-649R1	IC	A-D CON TC815CBU TELECOM	U1	1
611-654	TRANSISTOR	KST3904-MTF SAMSUNG	Q1	1

LGP P/N	Category	Specification	PCB F/N	Quantity
611-664	TRANSISTOR	KSC2328A	Q2	1
611-664	TRANSISTOR	KSC2328A	Q3	1
637-013	BUZZER	BUZZ SBT-11P	B1	1
648-052	CRYSTAL	32.768KHZ	Y1	1
873-028R	MN WIRE	MN WIRE CM2 10MOHM	R20	1
873-027	Mn WIRE CM2 DIA 1.6MM	Mn WIRE CM2 DIA1.6MM		1
884-029	PVC TUBE	PVC TUBE VIT-300 74MM ULE843		1
CK1HI103K	CAPACITOR	CER 0.01UF 50V K (2012)	C10	1
CK1HI104M	CAPACITOR	CER 0.1UF 50V M (2012)	C04	1
CK1HI104M	CAPACITOR	CER 0.1UF 50V M (2012)	C5,C13	2
CK1HI221J	CAPACITOR	CER 220PF 50V J (2012)	C02	1
CK1HI390J	CAPACITOR	CER 39PF 50V J (2012)	C01	1
RG0CP107J	RESISTOR	M.G 100 MOHM 1/2W 5%	R38	1
RG0CP226J	RESISTOR	M.G 22 MOHM 1/2W 5%	R26	1
RMAH1000J	RESISTOR	M.F 100 -OHM 1/8W 5% (3216)	R02	1
RMAH1000J	RESISTOR	M.F 100 -OHM 1/8W 5% (3216)	R2A	1
RMAH1001F	RESISTOR	M.F 1 KOHM 1/8W 1% (3216)	R16	1
RMAH1002F	RESISTOR	M.F 10 KOHM 1/8W 1% (3216)	R28	1
RMAH1002F	RESISTOR	M.F 10 KOHM 1/8W 1% (3216)	R29	1
RMAH1002J	RESISTOR	M.F 10 KOHM 1/8W 5% (3216)	R21	1
RMAH1003F	RESISTOR	M.F 100 KOHM 1/8W 1% (3216)	R08	1
RMAH1003J	RESISTOR	M.F 100 KOHM 1/8W 5% (3216)	R06	1
RMAH1003J	RESISTOR	M.F 100 KOHM 1/8W 5% (3216)	R34	1
RMAH1503J	RESISTOR	M.F 150 KOHM 1/8W 5% (3216)	R33	1
RMAH2203F	RESISTOR	M.F 220 KOHM 1/8W 1% (3216)	R32	1
RMAH2701F	RESISTOR	M.F 2.7 KOHM 1/8W 1% (3216)	R36	1
RMAH4702F	RESISTOR	M.F 47 KOHM 1/8W 1% (3216)	R35	1
RMAH4702J	RESISTOR	M.F 47 KOHM 1/8W 5% (3216)	R05	1
RMAH4703J	RESISTOR	M.F 470 KOHM 1/8W 5% (3216)	R27	1
RMAH4703J	RESISTOR	M.F 470 KOHM 1/8W 5% (3216)	R30	1
RMAH4703J	RESISTOR	M.F 470 KOHM 1/8W 5% (3216)	R37	1
RMAH7502J	RESISTOR	M.F 75 KOHM 1/8W 5% (3216)	R01	1
RMAH8201F	RESISTOR	M.F 8.2 KOHM 1/8W 1% (3216)	R31	1
RMAH8203J	RESISTOR	M.F 820 KOHM 1/8W 5% (3216)	R03	1
RMAH8203J	RESISTOR	M.F 820 KOHM 1/8W 5% (3216)	R04	1
RMBP9R00C	RESISTOR	M.F 9 -OHM 1/4W .25%	R18	1

Appendix B) Schematic diagram of DM-313

