Digital Multimeter

GDM-8245

Service MANUAL

GW INSTEK PART NO. 82DM-82450S01

ISO-9001 CERTIFIED MANUFACTURER

GW INSTEK

June 2011

The information in this manual was correct at the time of printing. However, Good Will continues to improve its products and therefore reserves the right to change the specifications, equipment, and maintenance procedures at any time without notice.

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SAFETY REQUIREMENTS

This chapter contains important safety instructions which should be followed when operating the instrument and keeping it in storage. Read the following before operating this instrument to ensure safety and to keep the instrument in best condition.

Safety Symbols and Terms

These safety symbols may appear in this manual or on the instrument.

 WARNING	Warning: Identifies conditions or practices that could result in injury or loss of life.
 CAUTION	Caution: Identifies conditions or practices that could result in damage to the instrument or to other objects.
	DANGER High Voltage
	Attention: Refer to the Manual
	Protective Conductor Terminal
	Earth (ground) Terminal
	Do not dispose electronic equipment as unsorted municipal waste. Please use a separate collection facility or contact the supplier from which this instrument was purchased.

Precautions Before Use

General guidelines


CAUTION

- Make sure that the voltage input level does not exceed DC1200V/AC1000V. (Limitations apply, please see the specifications)
- Make sure the current input level does not exceed 20A.
- Do not place any heavy objects on the GDM-8245.
- Avoid severe impact or rough handling that leads to damaging the GDM-8245.
- Do not discharge static electricity to the GDM-8245.
- Use only mating connectors, not bare wires, for the terminals.
- Do not perform measurement at the source of a low-voltage installation or at building installations (Note below).
- Do not disassemble the GDM-8245 unless you are qualified as service personnel.

(Note) EN 61010-1:2001 specifies the measurement categories and their requirements as follows. This instrument falls under category II and III. (1200V CAT II, 600V CAT III)

- Measurement category IV is for measurement performed at the source of low-voltage installation.
- Measurement category III is for measurement performed in the building installation.
- Measurement category II is for measurement performed on the circuits directly connected to the low voltage installation.
- Measurement category I is for measurements performed on circuits not directly connected to Mains.

Power supply


WARNING

- AC Input voltage: 100V/ 120V/ 230 V AC, 50/60Hz
- The power supply voltage should not fluctuate more than 15%.
- Connect the protective grounding conductor of the AC power cord to an earth ground, to avoid electrical shock.

Fuse


WARNING

- Fuse type:

• 100V/120V	• T0.1A 250V
• 230V	• T0.08A 250V

- Make sure the correct type of fuse is installed before power up.
- To avoid fire, only replace the fuse with the specified type and rating.
- Disconnect the power cord before fuse replacement.
- Make sure the cause of a fuse blowout is fixed before fuse replacement.

Cleaning the instrument	• Disconnect the power cord before cleaning. • Use a soft cloth dampened in a solution of mild detergent and water. Do not spray any liquid into the GDM-8245. • Do not use chemicals or cleaners containing harsh material such as benzene, toluene, xylene, and acetone.
Operating environment	• Location: Indoor, no direct sunlight, dust free, almost non-conductive pollution (Note below) • Relative Humidity: < 75% • Altitude: < 2000m • Temperature: 0°C to 50°C (operation) (Note) EN 61010-1:2001 specifies the pollution degrees and their requirements as follows. The GDM-8245 falls under degree 2. Pollution refers to "addition of foreign matter, solid, liquid, or gaseous (ionized gases), that may produce a reduction of dielectric strength or surface resistivity". • Pollution degree 1: No pollution or only dry, non-conductive pollution occurs. The pollution has no influence. • Pollution degree 2: Normally only non-conductive pollution occurs. Occasionally, however, a temporary conductivity caused by condensation must be expected. Pollution degree 3: Conductive pollution occurs, or dry, non-conductive pollution occurs which becomes conductive due to condensation which is expected. In such conditions, equipment is normally protected against exposure to direct sunlight, precipitation, and full wind pressure, but neither temperature nor humidity is controlled.
Storage environment	• Location: Indoor • Relative Humidity: < 75% (0~35°C),<50% (35~50°C)* • Temperature: −40°C to 70°C • *Excluding 2M/20MΩ ranges
Disposal 	Do not dispose this instrument as unsorted municipal waste. Please use a separate collection facility or contact the supplier from which this instrument was purchased. Please make sure discarded electrical waste is properly recycled to reduce environmental impact.

Power cord for the United Kingdom

When using the instrument in the United Kingdom, make sure the power cord meets the following safety instructions.

NOTE: This lead / appliance must only be wired by competent persons

⚠WARNING: THIS APPLIANCE MUST BE EARTHED

IMPORTANT: The wires in this lead are coloured in accordance with the following code:

Green/ Yellow:	Earth
Blue:	Neutral
Brown:	Live (Phase)

As the colours of the wires in mains leads may not correspond with the coloured markings identified in your plug/appliance, proceed as follows:
The wire which is coloured Green & Yellow must be connected to the Earth terminal marked with the letter E or by the earth symbol ⏚ or coloured Green or Green & Yellow.
The wire which is coloured Blue must be connected to the terminal which is marked with the letter N or coloured Blue or Black.
The wire which is coloured Brown must be connected to the terminal marked with the letter L or P or coloured Brown or Red.
If in doubt, consult the instructions provided with the equipment or contact the supplier.
This cable/appliance should be protected by a suitably rated and approved HBC mains fuse: refer to the rating information on the equipment and/or user instructions for details. As a guide, cable of $0.75mm^2$ should be protected by a 3A or 5A fuse. Larger conductors would normally require 13A types, depending on the connection method used.
Any moulded mains connector that requires removal /replacement must be destroyed by removal of any fuse & fuse carrier and disposed of immediately, as a plug with bared wires is hazardous if engaged in a live socket. Any re-wiring must be carried out in accordance with the information detailed on this label.

Declaration of Conformity

We
GOOD WILL INSTRUMENT CO., LTD.

(1) No.7-1, Jhongsing Rd., Tucheng Dist., New Taipei City, Taiwan
(2) No. 69, Lu San Road, Suzhou City (Xin Qu), Jiangsu Sheng, China
declare, that the below mentioned product

Type of Product: **Dual Display Digital Multimeter**
Model Number: **GDM-8245**

are herewith confirmed to comply with the requirements set out in the Council Directive on the Approximation of the Law of Member States relating to Electromagnetic Compatibility (2004/108/EC) and Low Voltage Directive (2006/95/EC).
For the evaluation regarding the Electromagnetic Compatibility and Low Voltage Directive, the following standards were applied:

◎ EMC

Electrical equipment for measurement, control and laboratory use— EMC requirements (2004/108/EC)	
Harmonized Standard	EN 61326-1:2006 EN 61326-2-1:2006
Conducted & Radiated Emission CISPR11: 2003+A1:2004+A2:2006	Electrostatic Discharge IEC 61000-4-2: 2001
Current Harmonics EN 61000-3-2: 2006	Radiated Immunity IEC 61000-4-3: 2006 + A1: 2007
Voltage Fluctuations EN 61000-3-3: 1995+A1: 2001 +A2: 2005	Electrical Fast Transients IEC 61000-4-4: 2004+Corr.1: 2006 +Corr.2: 2007
----------	Surge Immunity IEC 61000-4-5: 2005
----------	Conducted Susceptibility IEC 61000-4-6: 2003+A1: 2004 +A2 :2006
----------	Power Frequency Magnetic Field IEC 61000-4-8: 1993 + A1: 2000 IEC 61000-4-11: 2004

◎ **Safety**

Low Voltage Equipment Directive 73/23/EEC & amended by 93/68/EEC
EN 61010-1 : 2001 IEC 61010-1: 2001

INTRODUCTION

The GDM-8245 is a portable, dual-display digital multimeter suitable for a wide range of applications, such as production testing, research, and field verification.

Features

Performance	• High DCV accuracy: 0.03%+4 • High current range: 20A • High Voltage range: 1000V
Features	• 50000 count display • Multiple functions: ACV, DCV, ACA, DCA, R, C, Hz, Continuity Beeper, Diode test, MAX/MIN, REL, dBm and HOLD. • Manual or Auto ranging • AC true RMS or AC + DC true RMS

Package Contents

Below is the list of standard components and optional accessories for the GDM-8245, besides the main unit.

Standard items

Item	Description	Order information
Test lead x1		GTL-117
Power cord x1	Region dependant	See your distributor
User manual CDx1	Region dependant	See your distributor
Quick User Guide x1	Region dependant	
Others		
Calibration Certificate x1	Certificate of traceable calibration	

Specifications

The following specifications apply when the instrument is powered on for at least 30 minutes within +18°C to +28°C (64.4 to 82.4°F). Accuracy is expressed as ±(percentage of reading + digits), the AC specification is based on a 50% duty cycle, the power cord protective grounding conductor must be connected to ground, relative humidity not exceeding 75% and a 1-year calibration cycle.

DC Voltage

RANGE	RRSOLUTION	ACCURACY	INPUT IMPEDANCE
500mV	10uV	0.03%+4	10MΩ
5V	100uV	0.03%+4	11.1 MΩ
50V	1mV	0.03%+4	10.1MΩ
500V	10mV	0.03%+4	10MΩ
1000V	100mV	0.03%+9	10MΩ
Input Impedance		Approx. 10MΩ in parallel with < 100pF, all ranges.	
Normal Mode Rejection Ratio		>60dB at 60Hz or 50Hz	
Common Mode Rejection Ratio		>90dB at 60Hz or 50Hz	
Common Mode Voltage (Max.)		500V DC or peak AC.	
Maximum Input		450V DC or peak AC continuous on 500mV range.	
		1000V DC or peak AC continuous on other ranges.	
dBM (ref 600Ω)		63.8dBm ~ -97.7dBm.	

When the input exceeds the full scale of the selected range, the display will indicate over-range: "—OL—".

TRUE RMS AC, AC+DC VOLTAGE

Accuracy	Between 2% of range and full range.			
	Range	20Hz-45Hz	45Hz-1kHz	1kHz-2kHz
	500mV	1%+15	0.5%+15	0.5%+15
	5V	1%+15	0.5%+15	0.5%+15
	50V	1%+15	0.5%+15	0.5%+15
	500V	1%+15	0.5%+15	--------
	1000V	1%+15	0.5%+15	--------
	Range	2kHz-10kHz	10kHz-20kHz	20kHz-50kHz
	500mV	1%+15	2%+30	5%+30
	5V	1%+15	2%+30	5%+30
	50V	1%+15	2%+30	5%+30
	500V	--------	--------	--------
	1000V	--------	--------	--------
	500mV	10uV	10MΩ	
	5V	100uV	11.1 MΩ	
	50V	1mV	10.1MΩ	
	500V	10mV	10MΩ	
	1000V	100mV	10MΩ	
Input Impedance	Approx. 10MΩ in parallel with < 100pF, all ranges.			
Maximum Input	450V dc or peak ac continuous on 500mV range. 1000Vrms on other range.			
Crest Factor Range	3.0 at full scale.			
dBm (ref 600Ω)	63.8dBm ~ -97.7dBm.			
When the input exceeds the full scale of the selected range, the display will indicate over-range: "—OL—".				

Frequency measurement at ACV range

RANGE	FREQUENCY	INPUT LEVEL (SINE WAVE)	ACCURACY
500mV	10Hz ~ 50kHz	≥120mV	0.05%+1
	50kHz ~ 150kHz	≥200mV	0.05%+1
5V	10Hz ~ 200kHz	≥1.2V	0.05%+1
50V	20Hz ~ 200kHz	≥1.2V	0.05%+1
500V	20Hz ~ 1kHz	≥12V	0.05%+1
AC+DC measurement does not support AC+Hz function.			
Maximum Input	450V peak ac continuous on 500mV range. 500V peak ac continuous on the other ranges.		

DC Current

RANGE	RESOLUTION	ACCURACY	BURDEN VOLTAGE
500uA	0.01uA	0.2% +2	0.7Vmax.
5mA	0.1uA	0.2% +2	0.7Vmax.
50mA	1uA	0.2% +2	0.7Vmax.
500mA	10uA	0.2% +2	0.8Vmax.
2A	100uA	0.3% +2	0.8Vmax.
20A	1mA	0.3% +2	0.9Vmax.
Protection	Fuse protection for 500uA, 5mA, 50mA, 500mA and 2A ranges. To obtain accurate measurement results, please refrain from using the 20A terminal for more than 15 seconds when measuring high current.		
When the input exceeds the full scale of the selected range, the display will indicate over-range: "—OL—".			

TRUE RMS AC OR AC+DC CURRENT

Accuracy	Between 2% of range and full range.			
RANGE	20Hz-45Hz	45Hz-2kHz	2kHz-10kHz	10kHz-20kHz
500uA	1%+15	0.5%+15	1%+15	2%+15
5mA	1%+15	0.5%+15	1%+15	2%+15
50mA	1%+15	0.5%+15	1%+15	2%+15
500mA	1%+15	0.5%+15	————————	
2A	1%+15	0.5%+15	————————	
20A	1%+15	0.5%+15	————————	
Protection	Fuse protection 500uA, 5mA, 50mA, 500mA, and 2A ranges. To obtain accurate measurement results, please			

	refrain from using the 20A terminal for more than 15 seconds when measuring high current.
Crest Factor Range	3.0 at full scale.
The burden voltage is the same as the DC current.	

When the input exceeds the full scale of the selected range, the display will indicate over-range: "—OL—".

FREQUENCY MEASUREMENT AT ACA RANGE

RANGE	FREQUENCY	INPUT LEVEL (SINE WAVE)	ACCURACY
500uA	10Hz ~ 20kHz	≥90μA	0.05%+1
5mA	10Hz ~ 20kHz	≥0.9mA	0.05%+1
50mA	10Hz ~ 20kHz	≥9mA	0.05%+1
500mA	10Hz ~ 20kHz	≥90mA	0.05%+1
2A	10Hz ~ 2kHz	≥1A	0.05%+1
20A	10Hz ~ 2kHz	≥9A	0.05%+1

AC+DC measurement does not support AC+Hz function.

Resistance

RANGE	RESOLUTION	ACCURACY
500Ω	0.01Ω	0.1%+4
5kΩ	0.1Ω	0.1%+2
50kΩ	1Ω	0.1%+2
500kΩ	10Ω	0.1%+2
5MΩ	100Ω	0.2%+2
20MΩ	1kΩ	0.3%+2
Open-circuit Voltage	3.2 volts maximum on 500Ω, 1.3 volts maximum on all other ranges.	
Protection	450V dc or peak ac continuous.	

Capacitance

RANGE	RESOLUTION	ACCURACY
5nF *	0.001nF	≥1nF: 2%+10 <1nF & ≥0.5nF: 2%+20
50nF	0.01nF	≥10nF: 2%+10 <10nF & ≥5nF: 2%+30
500nF	0.1nF	2%+4
5uF	1nF	2%+4

50uF	10nF	2%+4
*5nF range is affected by the impedance of the test lead. For accuracy, please measure the range directly on the input terminal.		
Protection	450V dc or peak ac continuous.	

Diode check

Description	Display read forward voltage of diode.
Open Voltage	3.1V approx.
Maximum Forward Voltage	1.5V
Protection	450V dc or peak ac continuous.

Continuity Beeper

Description	Built in buzzer sounds when resistance is less than 5 ohm.
Open Voltage	3 volts maximum.
Protection	450V dc or peak ac continuous.

Environmental

Operation Environment	Indoor use, altitude up to 2000m. Ambient Temperature 0˚C to 50˚C. Relative Humidity 75% (Maximum). Installation category II Pollution Degree 2
Storage temperature	-40˚C to 70˚C.
Relative Humidity	< 75%, 0~35˚C < 50%, 35~50˚C (excluding 2MΩ and 20MΩ ranges).

General

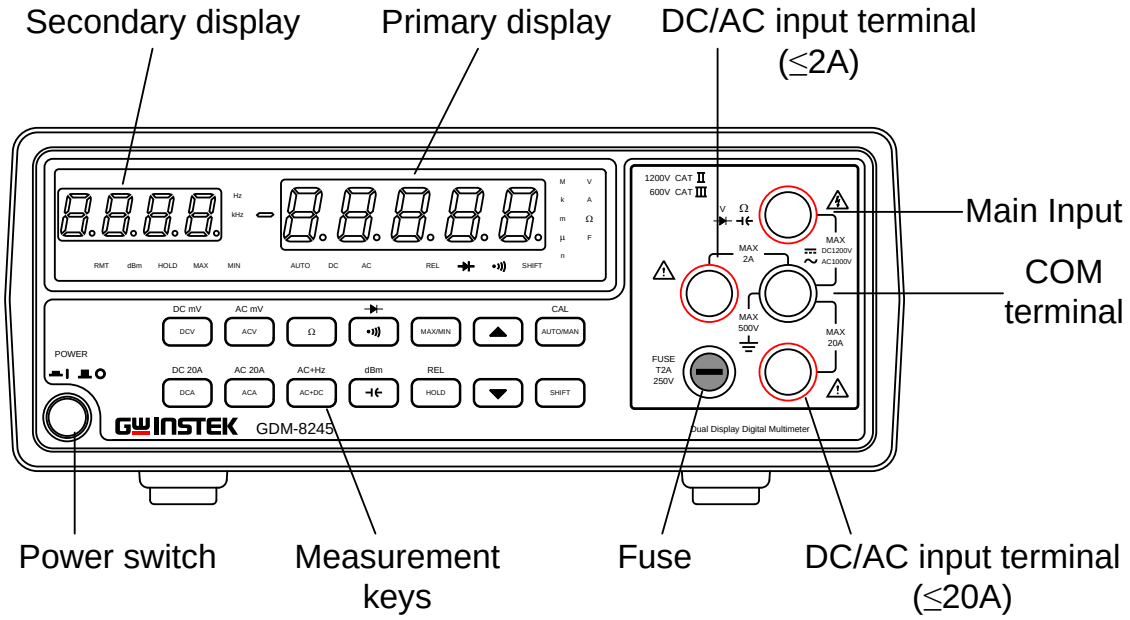
Maximum Common Mode Voltage	500V dc or peak ac (low terminal potential with respect to power line ground).
Warm Up	0.5 hours to achieve rated accuracy.
Power source	AC 100V/120V/230V±15%, 50/60Hz, 8VA, 6W.

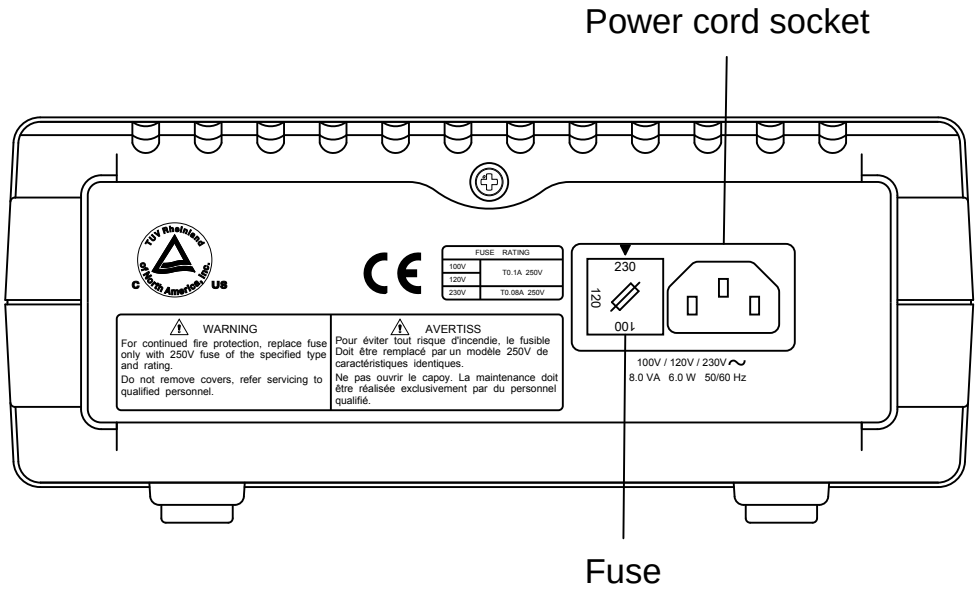
Accessories	Test Lead × 1 Quick Guide manual × 1
Dimension	251(W)×91(H)×291(D) mm
Weight	Approx. 2.6 kg

Input overload protection

FUNCTION	RANGE	MAXIMUN INPUT
DCV	5V~1000V	1000Vdc or peak AC
ACV (AC+DC)	5V~1000V	1000V rms continuous & 10^7 V·Hz maximum
DCA,ACA(AC+DC)	500uA~2A	fuse protected: T2A 250V
DC,AC20A(AC+DC)	20A	not fuse protected
DC, ACmV (AC+DC)	500mV	450V dc or AC peak
OHM	all ranges	450V dc or AC peak
CAPACITANCE	all ranges	450V dc or AC peak

Front/Rear Panel





CALIBRATION LOG

Print out these pages and record the results. Keep it with the instrument.

Model name	GDM-824__	Serial number	_____
Date	Year_____	Month_____	Date_____
Verified by	Name_____		
	Company/Contact_____		
Environment	Temperature_____°C	Humidity_____%	

Operating Voltage Verification

Item	Min limit	Result	Max limit	Pass/Fail
TP10~ GND	+14.5V	____V	15.5V	☐ Pass ☐ Fail
TP11~ GND	-15.5V	____V	-14.5V	☐ Pass ☐ Fail
TP12~ GND	+2.9V	____V	+3.3v	☐ Pass ☐ Fail
TP13~ GND	-3.3V	____V	-2.9V	☐ Pass ☐ Fail
TP14~ GND	+1.6V	____V	+2.0V	☐ Pass ☐ Fail
TP15~ GND	6.0V	____V	+6.4V	☐ Pass ☐ Fail

Short Calibration (Calibration mode CL10, CL20, CL40)

Item	Min limit	Pass	Fail
ACV short calibration (CL10)		☐ Pass	☐ Fail
DCA, ACA, DCV, Ω short calibration (CL20)		☐ Pass	☐ Fail
400mΩ short calibration (CL40)		☐ Pass	☐ Fail

ACV Frequency Response Calibration (Calibration mode CL50)

Item	Min limit	Result	Max limit	Pass/Fail
200mV/50Hz (ACmV)	- 4 digits	______mV	+ 4 digits	☐ Pass ☐ Fail
200mV/50Hz (AC+DC)	- 4 digits	______mV	+ 4 digits	☐ Pass ☐ Fail

2V/50Hz	– 4 digits	_____V	+ 4 digits	☐ Pass ☐ Fail
20V/50Hz	– 4 digits	_____V	+ 4 digits	☐ Pass ☐ Fail
200V/50Hz	– 4 digits	_____V	+ 4 digits	☐ Pass ☐ Fail
1000V/50Hz	– 4 digits	_____V	+ 4 digits	☐ Pass ☐ Fail

ACV Frequency Adjustment (Calibration mode CL50)

Item	Min limit	Result	Max limit	Pass/Fail
200mV/50kHz	200.50mV –10 digits	VC305 adjustment	200.50mV +10 digits	☐ Pass ☐ Fail
4.9V/10kHz	4.9000 V – 10 digits	VC301 adjustment	4.9000 V + 10 digits	☐ Pass ☐ Fail
49V/10kHz	49.000 – 10 digits	VC302 adjustment	49.000 + 10 digits	☐ Pass ☐ Fail
490V/1kHz	490.00 V – 10 digits	VC303 adjustment	490.00 V + 10 digits	☐ Pass ☐ Fail
1000V/1kHz (check)	– 20 digits	_____V	+ 20 digits	☐ Pass ☐ Fail

Capacitance Open Calibration (CL30)

Item	Min limit	Pass	Fail
Open Calibration (CL30)		☐ Pass	☐ Fail

Resistance Range Calibration

Item	Min limit	Result	Max limit	Pass/Fail
400Ω (500Ω Range)	– 3 digits	_____Ω	+ 3 digits	☐ Pass ☐ Fail
4 kΩ (5kΩ Range)	– 3 digits	_____Ω	+ 3 digits	☐ Pass ☐ Fail
40 kΩ (50kΩ Range)	– 3 digits	_____Ω	+ 3 digits	☐ Pass ☐ Fail
400 kΩ (500kΩ Range)	– 3 digits	_____Ω	+ 3 digits	☐ Pass ☐ Fail
3M Ω (5MΩ Range)	– 3 digits	_____Ω	+ 3 digits	☐ Pass ☐ Fail
9.907 MΩ (20 MΩ Range)	– 3 digits	_____Ω	+ 3 digits	☐ Pass ☐ Fail

20 MΩ (19 MΩ Range)	– 40 digits	_____Ω	+ 40 digits	☐ Pass ☐ Fail

DCV Calibration

Item	Min limit	Result	Max limit	Pass/Fail
400mV (500mV Range)	– 3 digits	_____mV	+ 3 digits	☐ Pass ☐ Fail
4V (5V Range)	– 3 digits	_____ V	+ 3 digits	☐ Pass ☐ Fail
40V (50V Range)	– 3 digits	_____ V	+ 3 digits	☐ Pass ☐ Fail
400V (500V Range)	– 3 digits	_____ V	+ 3 digits	☐ Pass ☐ Fail
1000V (1000V Range)	– 3 digits	_____ V	+ 3 digits	☐ Pass ☐ Fail

Diode Adjustment

Item	Pass	Fail
0.537V	☐ Pass (0.6616 Vreading)	☐ Fail
0.937V	☐ Pass (1.0000 V reading)	☐ Fail

DCA Adjustment

Item	Min limit	Result	Max limit	Pass/Fail
400uA (500uA Range)	– 3 digits	_____uA	+ 3 digits	☐ Pass ☐ Fail
4.0mA (5.0mA Range)	– 3 digits	_____ mA	+ 3 digits	☐ Pass ☐ Fail
40mA (50mA Range)	– 3 digits	_____ mA	+ 3 digits	☐ Pass ☐ Fail
400mA (500mA Range)	– 3 digits	_____ mA	+ 3 digits	☐ Pass ☐ Fail
2A (2A Range)	– 3 digits	_____ A	+ 3 digits	☐ Pass ☐ Fail
8A (20A Range)	– 3 digits	_____ A	+ 3 digits	☐ Pass ☐ Fail

ACA Adjustment

Item	Min limit	Result	Max limit	Pass/Fail
200uA/70Hz (500uA Range)	– 4 digits	_____uA	+ 4 digits	☐ Pass ☐ Fail

2mA/70Hz (5.0mA Range)	- 4 digits	_____ mA	+ 4 digits	☐ Pass ☐ Fail
20mA/70Hz (50mA Range)	- 4 digits	_____ mA	+ 4 digits	☐ Pass ☐ Fail
200mA/70Hz (500mA Range)	- 4 digits	_____ mA	+ 4 digits	☐ Pass ☐ Fail
2A/50Hz (2A Range)	- 4 digits	_____ A	+ 4 digits	☐ Pass ☐ Fail
8A (reading 8.010)/400Hz (20A Range)	- 4 digits	_____ A	+ 4 digits	☐ Pass ☐ Fail

Capacitance Adjustment

Item	Min limit	Result	Max limit	Pass/Fail
3.282nF (5nF Range)	- 3 digits	_____nF	+ 3 digits	☐ Pass ☐ Fail
30nF (50nF Range)	- 3 digits	_____ nF	+ 3 digits	☐ Pass ☐ Fail
300nF (500nF Range)	- 3 digits	_____ nF	+ 3 digits	☐ Pass ☐ Fail
3uF (5uF Range)	- 3 digits	_____ uF	+ 3 digits	☐ Pass ☐ Fail
30uF (50uF Range)	- 3 digits	_____ uF	+ 3 digits	☐ Pass ☐ Fail

VERIFICATION LOG

Print out these pages and record the results. Keep it with the instrument.

Model name GDM-824__ Serial number _____

Date Year_____ Month_____ Date_____

Verified by Name_____

Company/Contact_____

Environment Temperature_____°C Humidity_____%

Operating Voltage Verification

Item	Min limit	Result	Max limit	Pass/Fail
TP10~ GND	+14.5V	____V	15.5V	☐ Pass ☐ Fail
TP11~ GND	-15.5V	____V	-14.5V	☐ Pass ☐ Fail
TP12~ GND	+2.9V	____V	+3.3v	☐ Pass ☐ Fail
TP13~ GND	-3.3V	____V	-2.9V	☐ Pass ☐ Fail
TP14~ GND	+1.6V	____V	+2.0V	☐ Pass ☐ Fail
TP15~ GND	6.0V	____V	+6.4V	☐ Pass ☐ Fail

LED brightness Verification

Item	Pass/Fail	
Primary LED	☐ Pass	☐ Fail
Secondary LED	☐ Pass	☐ Fail

Power Supply Verification

Item	Min limit	Result	Max limit	Pass/Fail
115V input	40mA	____A	50mA	☐ Pass ☐ Fail
230V input	17mA	____A	27mA	☐ Pass ☐ Fail

Resistance Verification (Short)

Item	Min limit	Result	Max limit	Pass/Fail
Short (1Ω Range)	- 2 digits	_____Ω	+ 2 digits	☐ Pass ☐ Fail

Short (100Ω Range)	– 2 digits	_____Ω	+ 2 digits	☐ Pass ☐ Fail
Short (500Ω Range)	– 3 digits	_____Ω	+ 3 digits	☐ Pass ☐ Fail
Short (5kΩ Range)	– 2 digits	_____Ω	+ 2 digits	☐ Pass ☐ Fail
Short (50kΩ Range)	– 2 digits	_____Ω	+ 2 digits	☐ Pass ☐ Fail
Short (500kΩ Range)	– 2 digits	_____Ω	+ 2 digits	☐ Pass ☐ Fail
Short (5MΩ Range)	– 2 digits	_____Ω	+ 2 digits	☐ Pass ☐ Fail
Short (20 MΩ Range)	– 2 digits	_____Ω	+ 2 digits	☐ Pass ☐ Fail

Resistance Range Verification

Item	Min limit	Result	Max limit	Pass/Fail
1Ω (1Ω Range)	– 4 digits	_____Ω	+ 4 digits	☐ Pass ☐ Fail
100Ω (100Ω Range)	–11 digits	_____Ω	+ 11 digits	☐ Pass ☐ Fail
490 Ω (500Ω Range)	– 37 digits	_____Ω	+ 37 digits	☐ Pass ☐ Fail
4.9 kΩ (5kΩ Range)	– 36 digits	_____Ω	+ 36 digits	☐ Pass ☐ Fail
49 kΩ (50kΩ Range)	– 36 digits	_____Ω	+ 36 digits	☐ Pass ☐ Fail
490 kΩ (500kΩ Range)	– 36 digits	_____Ω	+ 36 digits	☐ Pass ☐ Fail
4.9 MΩ (5MΩ Range)	– 70 digits	_____Ω	+ 70 digits	☐ Pass ☐ Fail
19 MΩ (20 MΩ Range)	– 41 digits	_____Ω	+ 41 digits	☐ Pass ☐ Fail

Diode Verification

Item	Pass	Fail
0.5~0.7	☐ Pass	☐ Fail

Over	☐ Pass	☐ Fail

Capacitance Verification (Open)

Item	Min limit	Result	Max limit	Pass/Fail
Open (5nF Range)	– 3 digits	_____nF	+ 3 digits	☐ Pass ☐ Fail
Open (50nF Range)	– 2 digits	_____ nF	+ 2 digits	☐ Pass ☐ Fail
Open (500nF Range)	– 2 digits	_____ nF	+ 2 digits	☐ Pass ☐ Fail
Open (5uF Range)	– 2 digits	_____ uF	+ 2 digits	☐ Pass ☐ Fail
Open (50uF Range)	– 2 digits	_____ uF	+ 2 digits	☐ Pass ☐ Fail

Capacitance Verification

Item	Min limit	Result	Max limit	Pass/Fail
1.006 (5nF Range)	– 28 digits	_____nF	+ 28 digits	☐ Pass ☐ Fail
49nF (50nF Range)	– 76 digits	_____ nF	+ 76 digits	☐ Pass ☐ Fail
490nF (500nF Range)	– 71 digits	_____ nF	+ 71 digits	☐ Pass ☐ Fail
4.9uF (5uF Range)	– 71 digits	_____ uF	+ 71 digits	☐ Pass ☐ Fail
49uF (50uF Range)	– 71 digits	_____ uF	+ 71 digits	☐ Pass ☐ Fail

DCA Short Verification

Item	Min limit	Result	Max limit	Pass/Fail
Short (500uA Range)	– 3 digits	_____uA	+ 3 digits	☐ Pass ☐ Fail
Short (5.0mA Range)	– 3 digits	_____ mA	+ 3 digits	☐ Pass ☐ Fail
Short (50mA Range)	– 3 digits	_____ mA	+ 3 digits	☐ Pass ☐ Fail
Short (500mA Range)	– 3 digits	_____ mA	+ 3 digits	☐ Pass ☐ Fail
Short (2A Range)	– 3 digits	_____ A	+ 3 digits	☐ Pass ☐ Fail

Short (20A Range)	- 3 digits	_____ A	+ 3 digits	☐ Pass ☐ Fail

DCA Verifcation

Item	Min limit	Result	Max limit	Pass/Fail
490uA (500uA Range)	- 70 digits	_____uA	+ 70 digits	☐ Pass ☐ Fail
4.9mA (5.0mA Range)	- 70 digits	_____ mA	+ 70 digits	☐ Pass ☐ Fail
49mA (50mA Range)	- 70 digits	_____ mA	+ 70 digits	☐ Pass ☐ Fail
490mA (500mA Range)	- 70 digits	_____ mA	+ 70 digits	☐ Pass ☐ Fail
1.9A (2A Range)	- 41 digits	_____ A	+ 41 digits	☐ Pass ☐ Fail
19A (20A Range)	- 41 digits	_____ A	+ 41 digits	☐ Pass ☐ Fail

ACA Verification

Item	Result	limit	Pass/Fail
490uA/20Hz (500uA Range)	_____uA	< 378 digits	☐ Pass ☐ Fail
490uA/2kHz (500uA Range)	_____uA	< 195 digits	☐ Pass ☐ Fail
490uA/20kHz (500uA Range)	_____uA	< 746 digits	☐ Pass ☐ Fail
4.9mA/20Hz (5.0mA Range)	_____ mA	< 378 digits	☐ Pass ☐ Fail
4.9mA/2kHz (5.0mA Range)	_____ mA	< 195 digits	☐ Pass ☐ Fail
4.9mA/20kHz (5.0mA Range)	_____ mA	< 746 digits	☐ Pass ☐ Fail
49mA/20Hz (50mA Range)	_____ mA	< 378 digits	☐ Pass ☐ Fail
49mA/2kHz (50mA Range)	_____ mA	< 195 digits	☐ Pass ☐ Fail
49mA/20kHz (50mA Range)	_____ mA	< 746 digits	☐ Pass ☐ Fail

490mA/20Hz (500mA Range)	_____ mA	< 378 digits	☐ Pass ☐ Fail
490mA/400Hz (500mA Range)	_____ mA	< 195 digits	☐ Pass ☐ Fail
490mA/2kHz (500mA Range)	_____ mA	< 195 digits	☐ Pass ☐ Fail
1.9A/20Hz (2A Range)	_____ A	< 153 digits	☐ Pass ☐ Fail
1.9A/400Hz (2A Range)	_____ A	< 82 digits	☐ Pass ☐ Fail
1.9A/2kHz (2A Range)	_____ A	< 82 digits	☐ Pass ☐ Fail
19A /20Hz (20A Range)	_____ A	< 153 digits	☐ Pass ☐ Fail
19A /400Hz (20A Range)	_____ A	< 82 digits	☐ Pass ☐ Fail
19A /2kHz (20A Range)	_____ A	< 82 digits	☐ Pass ☐ Fail

ACV Short Verification

Item	Result	Max limit	Pass/Fail
Short (500mV Range)	_____mV	< 3digits	☐ Pass ☐ Fail
Short (5V Range)	_____V	< 3digits	☐ Pass ☐ Fail
Short (50V Range)	_____V	< 3digits	☐ Pass ☐ Fail
Short (500V)	_____V	< 3digits	☐ Pass ☐ Fail

ACV Verification (part I)

Item	Result	Max limit	Pass/Fail
490mV/20Hz (500mV Range)	_____mV	< 353digits	☐ Pass ☐ Fail
490mV/2kHz (500mV Range)	_____V	< 182 digits	☐ Pass ☐ Fail
490mV/10kHz (500mV Range)	_____V	< 353 digits	☐ Pass ☐ Fail

490mV/20kHz (500mV Range)	_____V	< 707 digits	☐ Pass ☐ Fail
490mV/50kHz (500mV Range)	_____V	< 1736 digits	☐ Pass ☐ Fail

AC+DC Verification

Item	Result	Max limit	Pass/Fail
200mV/50kHz (500mV Range)	_____V	< 721digits	☐ Pass ☐ Fail

ACV Verification (part II)

Item	Result	Max limit	Pass/Fail
4.9V/20Hz (5V Range)	_____V	< 353digits	☐ Pass ☐ Fail
4.9V/2kHz (5V Range)	_____V	< 182digits	☐ Pass ☐ Fail
4.9V/10kHz (5V Range)	_____V	< 353digits	☐ Pass ☐ Fail
4.9V/20kHz (5V Range)	_____V	< 707digits	☐ Pass ☐ Fail
4.9V/50kHz (5V Range)	_____V	< 1736digits	☐ Pass ☐ Fail
49V/20Hz (50V Range)	_____V	< 353digits	☐ Pass ☐ Fail
49V/2kHz (50V Range)	_____V	< 182digits	☐ Pass ☐ Fail
49V/10kHz (50V Range)	_____V	< 353digits	☐ Pass ☐ Fail
49V/20kHz (50V Range)	_____V	< 707digits	☐ Pass ☐ Fail
49V/50kHz (50V Range)	_____V	< 1736digits	☐ Pass ☐ Fail
490V/40Hz (50V Range)	_____V	< 353digits	☐ Pass ☐ Fail

490V/1kHz (500V Range)	_____V	< 182digits	☐ Pass ☐ Fail
1000V/40Hz (1000V Range)	_____V	< 80digits	☐ Pass ☐ Fail
1000V/1kHz (1000V Range)	_____V	< 45digits	☐ Pass ☐ Fail
800V/40Hz (1000V Range)	_____V	< 66digits	☐ Pass ☐ Fail
800V/1kHz (1000V Range)	_____V	< 38digits	☐ Pass ☐ Fail

There is no adjustment point for the 1kV range. However, the 1kV/50Hz range can be downward calibrated. After the downward calibration, the 1kHz frequency can then be tested again.

DCV Short Verification

Item	Result		Max limit	Pass/Fail
Short (500mV Range)	- 3 digits	_____mV	+ 3 digits	☐ Pass ☐ Fail
Short (5V Range)	- 3 digits	_____V	+ 3 digits	☐ Pass ☐ Fail
Short (50V Range)	- 3 digits	_____V	+ 3 digits	☐ Pass ☐ Fail
Short (500V)	- 3 digits	_____V	+ 3 digits	☐ Pass ☐ Fail
Short (1000V)	- 7 digits	_____V	+ 7 digits	☐ Pass ☐ Fail

DCV Verification (partl)

Item	Min limit	Result	Max limit	Pass/Fail
490mV (500mV Range)	- 14 digits	_____mV	+ 14 digits	☐ Pass ☐ Fail
-490mV (-500mV Range)	- 14 digits	_____mV	+ 14 digits	☐ Pass ☐ Fail
4.9V (5V Range)	- 14 digits	_____ V	+ 14 digits	☐ Pass ☐ Fail

DCV Verification (dB)

Item	Min limit	Result	Max limit	Pass/Fail
4.9V (5V Range)	- 15.99 dB	_____ dB	+ 16.05dB	☐ Pass ☐ Fail

DCV Verification (partI)

Item	Min limit	Result	Max limit	Pass/Fail
-4.9V (5V Range)	- 14 digits	_____ V	+ 14 digits	☐ Pass ☐ Fail
49V (50V Range)	- 14 digits	_____ V	+ 14 digits	☐ Pass ☐ Fail
-49V (50V Range)	- 14 digits	_____ V	+ 14 digits	☐ Pass ☐ Fail
490V (500V Range)	- 14 digits	_____ V	+ 14 digits	☐ Pass ☐ Fail
-490V (500V Range)	- 14 digits	_____ V	+ 14 digits	☐ Pass ☐ Fail
1000V (1000V Range)	- 9 digits	_____ A	+ 9 digits	☐ Pass ☐ Fail
-1000V (1000V Range)	- 9 digits	_____ A	+ 9 digits	☐ Pass ☐ Fail

Buzzer Test

Range	Test	Complete
$<5\Omega$	ON	☐ Pass ☐ Fail
$>7\Omega$	OFF	☐ Pass ☐ Fail

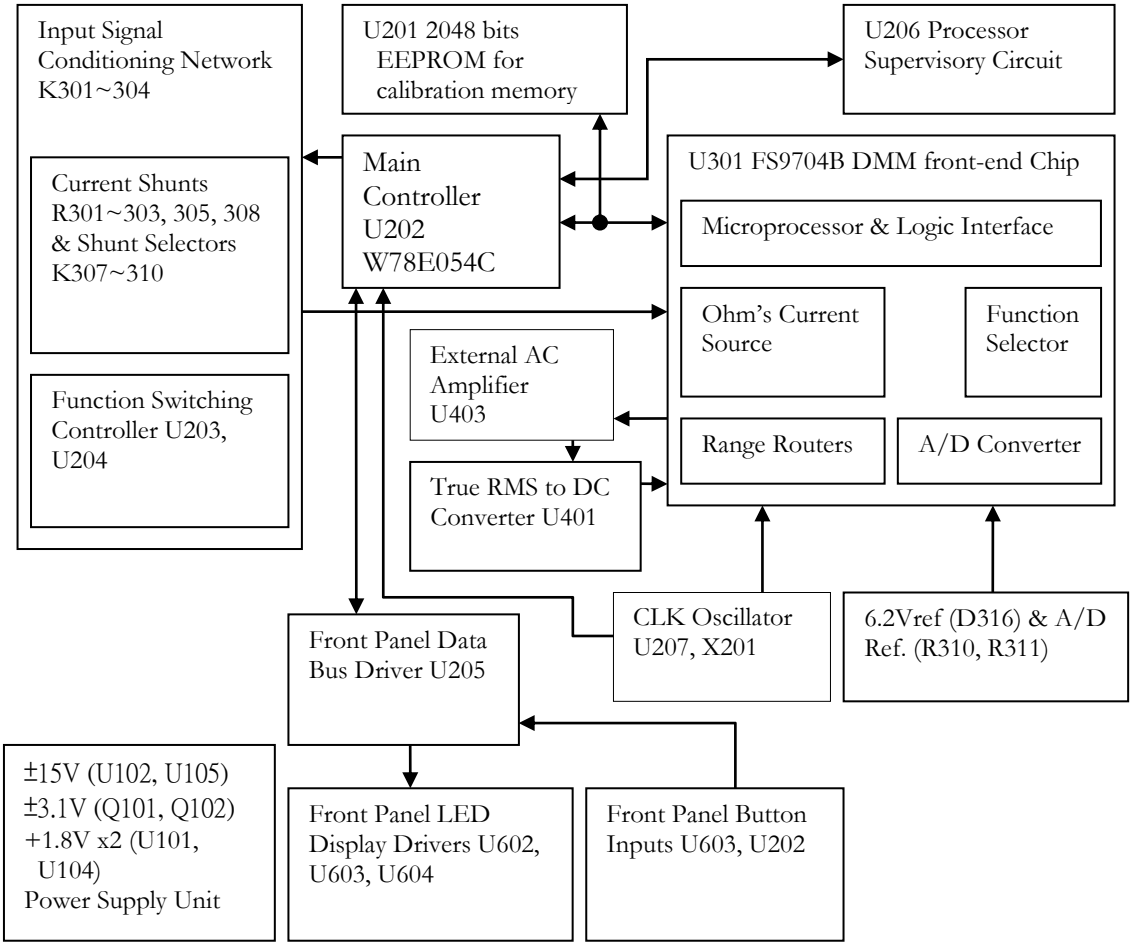
Frequency Verification (AC+Hz)

Item	Min limit	Result	Max limit	Pass/Fail
1.1V/200kHz	- 2 digits	_____ kHz	+ 2 digits	☐ Pass ☐ Fail

BLOCK DIAGRAM

Block Diagram Description

The block diagram below shows the GDM-8245 system block diagram. The system block can be divided into 3 main parts: power supply circuitry, digital control circuitry and analog signal processing circuitry. A detailed summary of each section follows.



Overview

The FS9704B, a 50,000 count digital multi-function meter front-end chip is the core of the GDM-8245. This versatile chip contains a high resolution sigma-delta ADC, functional network, operational amplifier, comparator, digital filter, digital control logic and an embedded microprocessor. Combined with a microprocessor, the FS9704B provides auto-range capabilities to measure DC/AC voltage, current, resistance, frequency and diode, etc.

Apart from the core chip, there is analog signal processing circuitry to attenuate and process the DC/AC voltage and current before feeding them into the ADC inside the FS9704B. Major components of the analog signal processing circuitry include the current shunt resistors that are used to render the input AC/DC current into a measurable voltage (U403, 9.25X voltage amplifier), and the U401, a true RMS-to-DC converter (AD536).

The digital control circuitry displays the measurement reading, reads the user's input from the front panel and actuates the relays used in the analog circuitry. The digital control circuitry consists of U202 (W78E054C) and the other peripheral controllers.

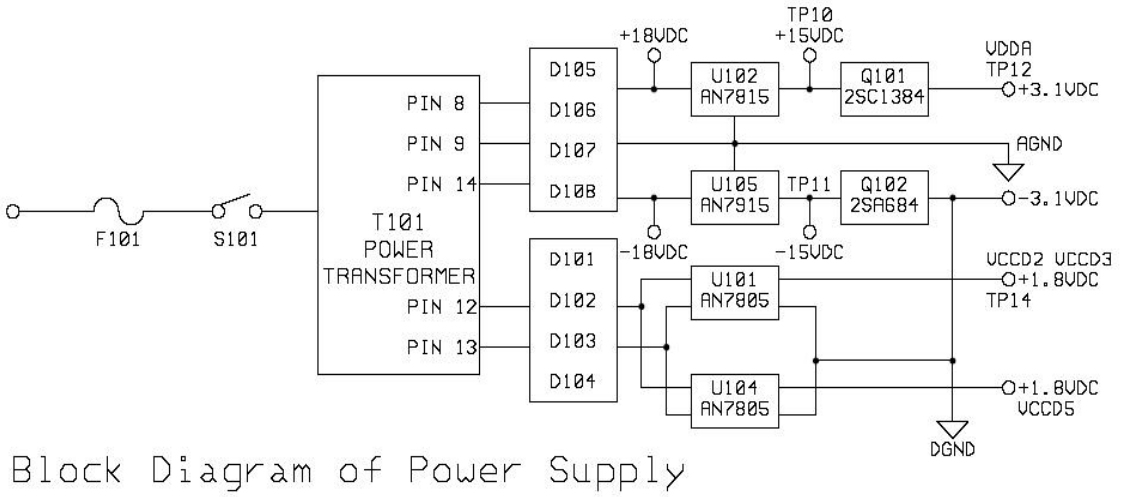
All the essential parts mentioned above need to be properly regulated with DC power supply circuitry that provides six different DC voltage outputs: ±15V, ±3.1V and two sets of +1.8V outputs.

Power Supply

As shown in the figure below, the ac power sources on pin 8 and pin 14 of T101 are rectified by D105, D106, D107 and D108 to be the ±18Vdc unregulated power sources. The ±18Vdc unregulated voltage sources are fed into the voltage regulators U102 (AN7815) and U105 (AN7915) to obtain the regulated ±15Vdc power sources, and then the regulated ±15Vdc power sources are fed into both the secondary voltage regulation circuitry which are composed of Q101 (2SC1384) and Q102 (2SA684) to produce the ±3.1Vdc regulated power sources.

The secondary ac power source on pin 12 and pin 13 of T101 are rectified by D101, D102, D103, D104 to obtain an unregulated +7.8Vdc power source which is then fed into two

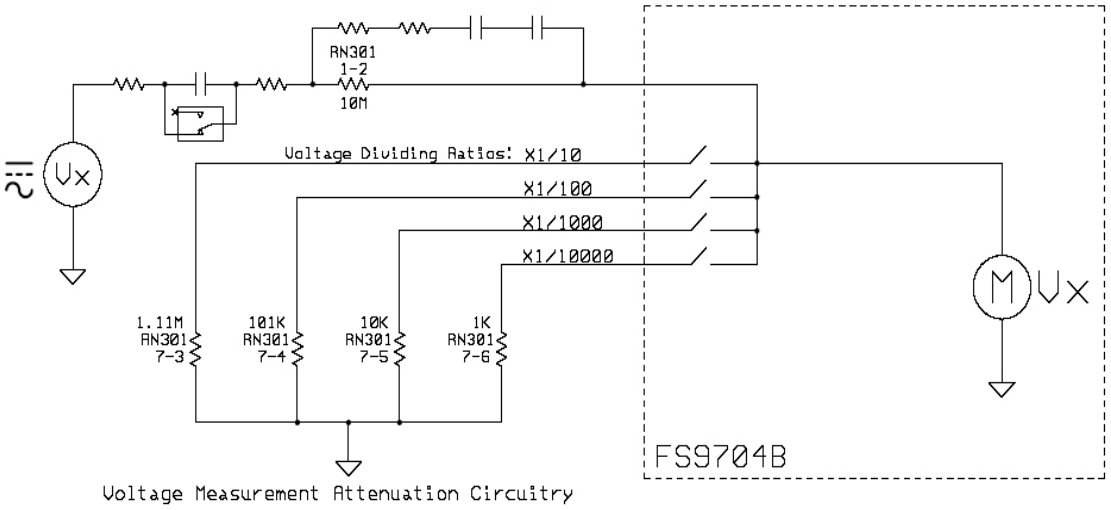
sets of +5Vdc regulator U101 and U104 (both are AN7805) to produce two sets of +5Vdc regulated power sources. However, these two sets of +5Vdc regulated power sources are not used as +5Vdc power sources, they are used as two sets of +1.8Vdc power sources by connecting their ground to the -3.1Vdc output of Q102.



Block Diagram of Power Supply

Attenuation

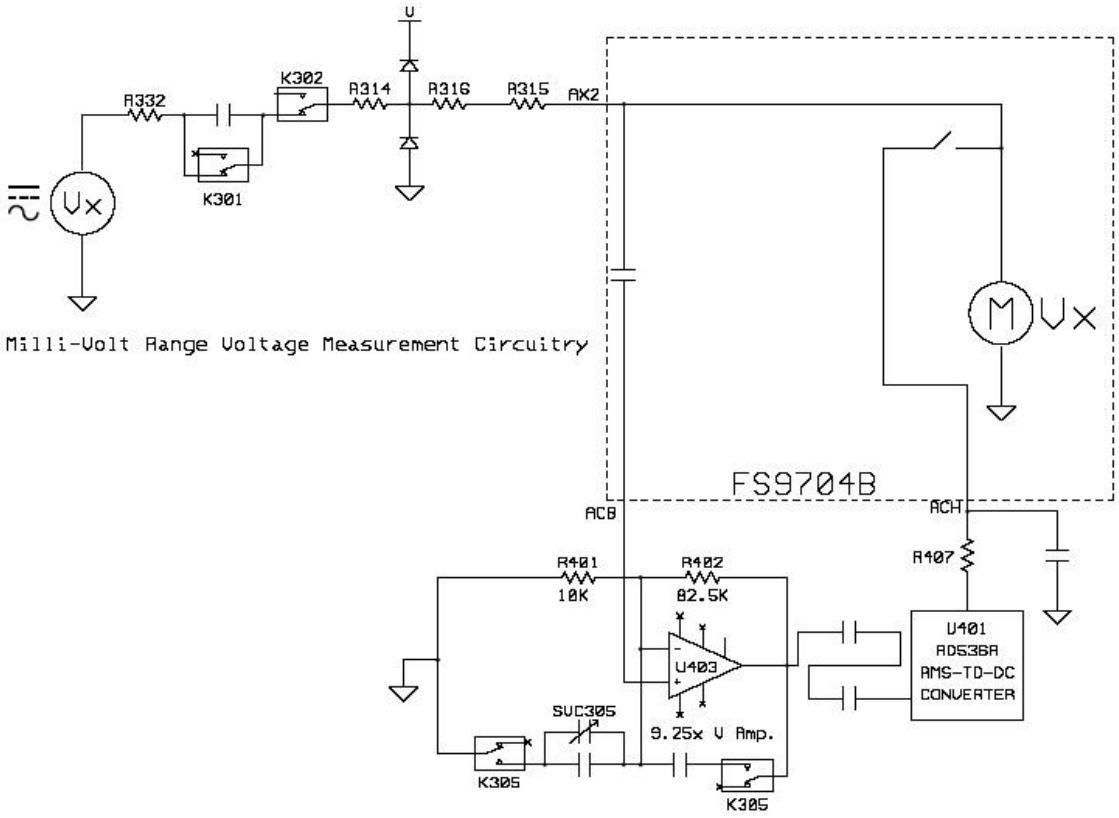
When being measured, higher level AC and DC voltage inputs (except milli-volt signals) are properly attenuated by RN301 with automatically or manually selected voltage dividers to fit into the input range of the A/D converter. There are a total of five resistors inside RN301: a 10MΩ high resistance input resistor and four selectable voltage dividing resistors: a 1.11MΩ, a 101kΩ, a 10kΩ and a 1kΩ resistor. Each of the four voltage dividing resistors can be selected to create a series circuit with the 10MΩ input resistor to form a voltage dividing circuit that creates one of four dividing ratios of 1/10, 1/100, 1/1000 and 1/10000.



Voltage Measurement Attenuation Circuitry

Milli-volt Attenuation

Signals for the milli-volt range are fed straight into the A/D converter (AX2 terminal) without attenuation, though the signal has high impedance protection provided by the resistor R314.

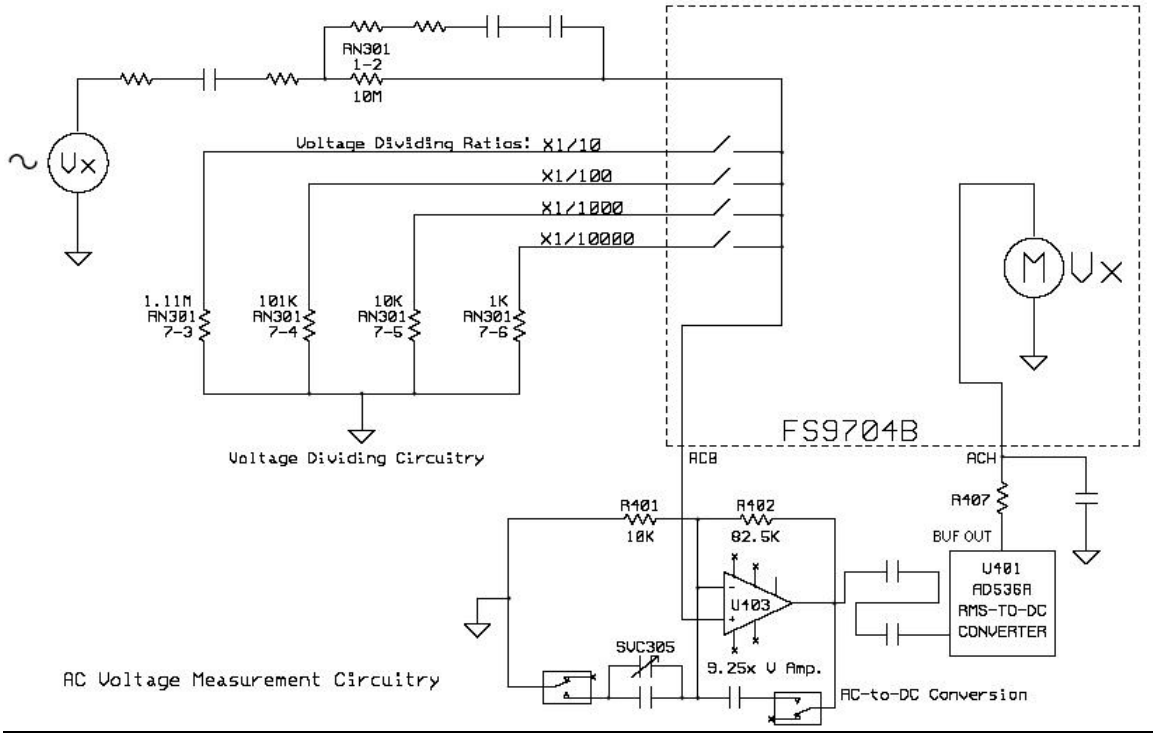


Milli-Volt Range Voltage Measurement Circuitry

AC Amplifier & AC-to-DC Conversion

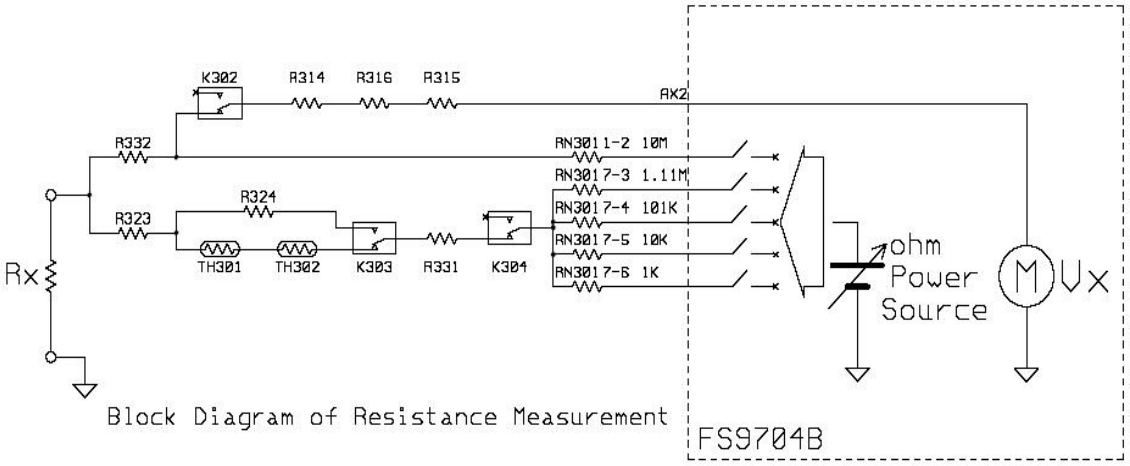
Both AC voltage and current input signals are amplified by U403 (OP37G) which amplifies the voltage 9.25X before being sent into the rms-to dc converter.

The AC input signals are converted to dc voltages for measurement. The conversion is done by a monolithic integrated circuit, AD536A which performs true rms-to-dc conversion. The AD536 directly computes the true rms value of any complex input waveform containing ac and dc components and provides an equivalent DC level.



Ohms Conversion

When measuring resistance, the required resistance (Ω) power source is provided by the fixed voltage generator inside FS9704B. As shown below, the measuring current flows through one of the five scale resistors in RN301 to pass the unknown Rx and thus having a voltage drop Vx produced on Rx. And then the Vx is measured by having it fed through R314 into the AX2 input terminal of the A/D converter inside FS9704B. The unknown Rx can be calculated by having the Ω power source's voltage divided by Vx and then times the selected scale resistor.

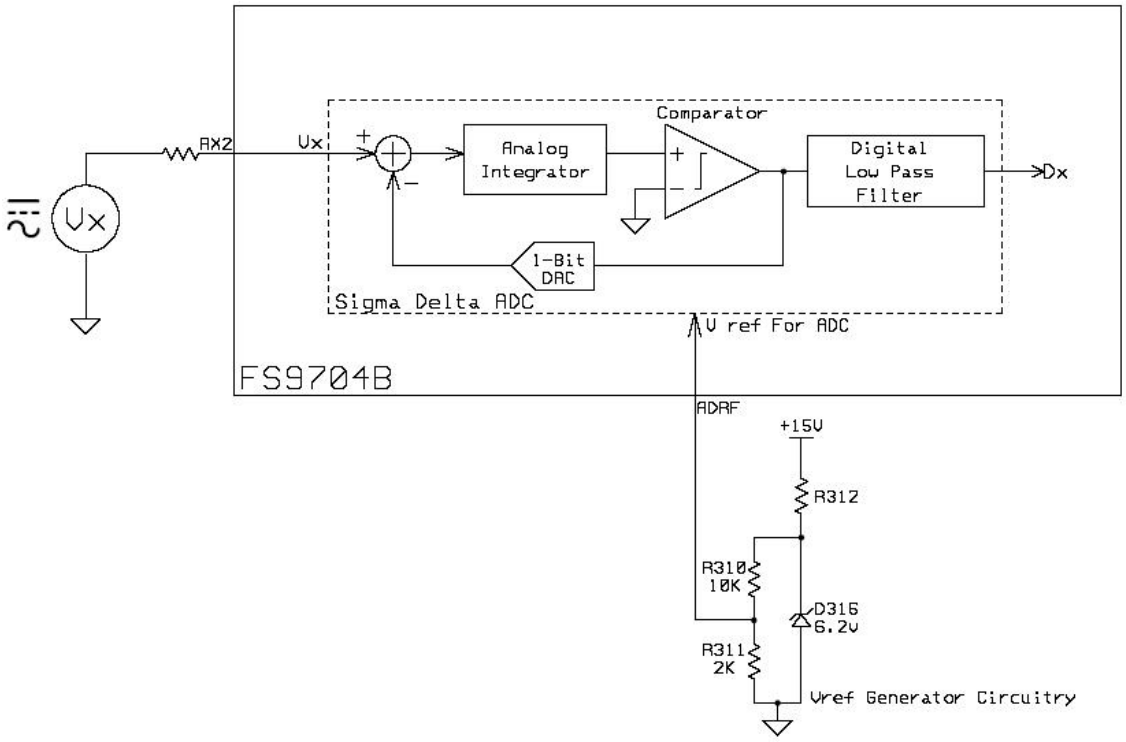


Block Diagram of Resistance Measurement

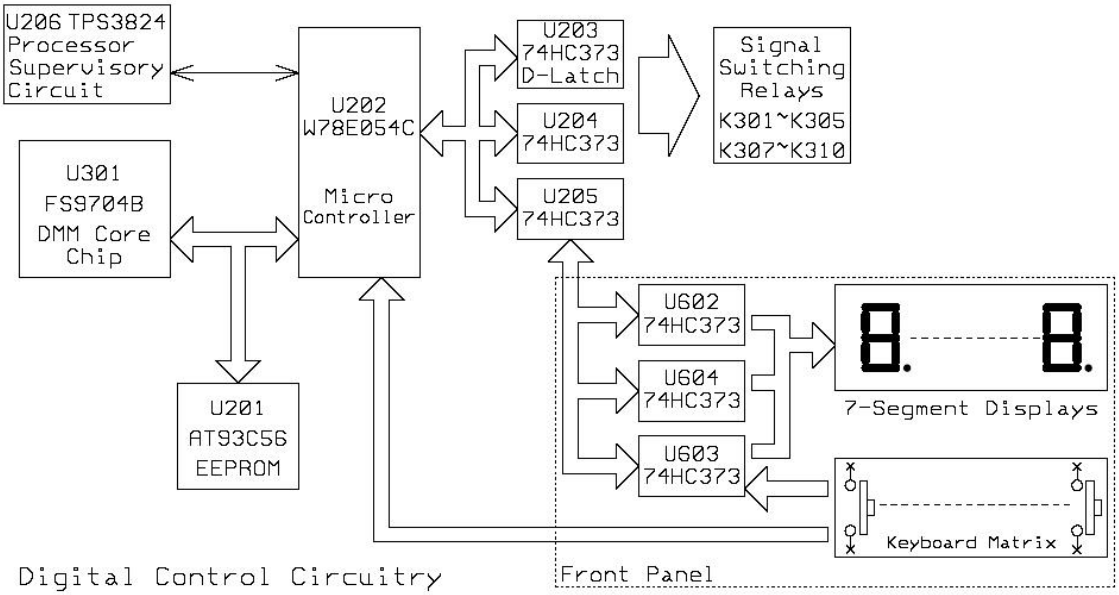
A/D Converter & Its Voltage Reference

The ADC inside FS9704B is a high-resolution sigma-delta converter; it includes a summing junction, an integrator, a comparator, a one-bit DAC and a digital low-pass filter. The input signal Vx comes into the integrator via a summing junction. It then passes through the integrator which feeds a comparator that acts as a one-bit quantizer. The comparator output is fed back to the input summing junction via a one-bit digital-to-analog converter (DAC), and it also passes through the digital filter and emerges at the output of the converter. The feedback loop forces the output of DAC to be equal to the input signal Vx. The function of the digital filter is to provide a sharp cutoff at the bandwidth of interest which essentially removes out of band quantization noise and signals.

ADC's reference voltage, which is approximately 1.024V, is generated by dividing the Vz (6.2V) on the zener diode (D316) with the ratio of 1/6. The Vz divider is composed of R310 and R311, which are connected in series to provide the dividing ratio of 1/6.



Current-to-Voltage Conversion	When measuring AC/DC current, the current needs to be processed and handled as a voltage. That's why we need shunt resistors to do the conversion. When current flows through a shunt resistor, a voltage drop presents on the shunt and the current value can be calculated by having the voltage drop across the shunt divided by the resistance of that shunt resistor. Shunt resistors R301~R303, R305 and R308 as well as an additional 0.01Ω resistor (attached in series with the 20A input terminal -no part number given) are used for current measurement. K307~K310 are the relays used to select the proper shunt resistors for a given current measurement range.
Digital Control Logic	An additional microcontroller, U202 is used to drive the seven-segment displays, receive input from the keyboard matrix and actuate the signal switching relays in the signal conditioning circuit. U206 (TPS3824,) a processor supervisory circuit which is also used as a watchdog timer, provides circuit initialization and timing supervision for the processor-based system. U201, (AT93C56) is a 2K EEPROM that is used to store temporary variables and readings when measuring. All the data which is received from the keyboard matrix or transmitted to the seven-segment LED display on the front panel are buffered by the octal D-type transparent latches (74HC373).


U206 TPS3824
Processor
Supervisory
Circuit
U202
W78E054C
Micro
Controller
U203
74HC373
D-Latch
U204
74HC373
U205
74HC373
Signal
Switching
Relays
K301~K305
K307~K310
U301
FS9704B
DMM Core
Chip
U201
AT93C56
EEPROM
U602
74HC373
U604
74HC373
U603
74HC373
7-Segment Displays
Keyboard Matrix
Digital Control Circuitry
Front Panel

TROUBLE SHOOTING

Use the trouble shooting chapter to diagnose common problems for servicing. Each trouble shooting section will describe the proper working condition for each of the major components.

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WARNING

Servicing should only be performed by a qualified technician. The following sections involve working in close proximity to dangerous voltages. When working with or near AC Power supplies, live voltages are present on exposed parts/components. Ensure proper care and precautions are used. Before using the *Trouble Shooting* chapter, read the *Safety Requirements* and *Precautions Before Use* section. Failure to do so may damage the instrument or result in injury or death.

Power-On Test

When switched on, the GDM-8245 will beep and then perform a display test by lighting up every LED on the front panel for around two seconds. By observing this power-on test, service personnel can easily tell if there is any display defect or problems in the power-on process.

Power Supply Checks

Symptom

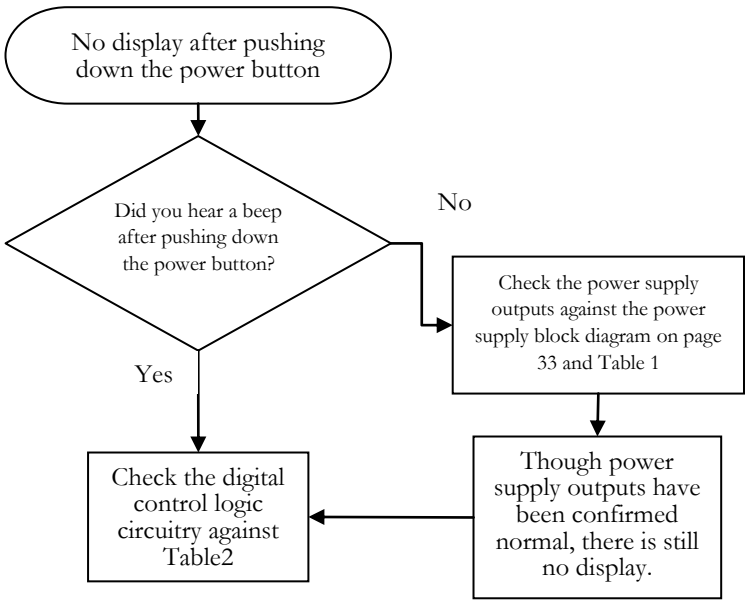
Power supply related problems can be checked out by referring to the power supply circuitry section, figure 2 (power supply block diagram) in the "Theory of operation". The steps in the table below can be used to narrow down any power supply related problems.

Table 1

Step	Item	Expected Conditions	Comments
1	Line fuse	Check continuity.	Remove to check.
2	Line voltage	100V/120V/230V as required.	Check fuse cover is aligned with the correct voltage. See page 80.
3	Line power	Plugged into live receptacle, power on.	
4	U102 input (Pin 1)	+18VDC	Referenced to U102 (Pin2)
5	U105 input (Pin 2)	-18VDC	Referenced to U105 (Pin1)
6	TP10	+15VDC	Referenced to U102 (Pin2)
7	TP11	-15VDC	Referenced to U102 (Pin2)
8	TP12	+3.1VDC	Referenced to U102 (Pin2)
9	Emitter of Q102	-3.1VDC	Referenced to U102 (Pin2)
10	TP14	+1.8VDC	Referenced to U102 (Pin2)
11	Pin 3 of U104	+1.8VDC	Referenced to U102 (Pin2)

Display Board Checks

If the display is blacked out after pressing the power button, it indicates a problem either on the display board or the power supply circuitry. Please refer to the Digital control circuitry in the digital control logic section, power supply circuitry section and use flow chart 1 and Table 2 listed below for the troubleshooting.



Flowchart 1 Display related problem trouble shooting process

Table 2

Step	Item	Expected Conditions	Comments
1	Power-on display test	LED display should be lit up for 2 seconds	Push down the power button to start the test
2	J201 pin 18 to pin 16	+5VDC	Digital +5V supply on the display board
3	U202, pin 19	4MHz clock pulse	Controller's 4MHz clock pulse
4	U205's clock pulse on pin 11	268Hz clock pulse	Referenced to pin 10
5	U604's clock	Pulse train of about 268Hz can be measured	On J601, pin 14 to pin 16
6	U603's clock	Pulse train of about 268Hz can be measured	On J601, pin 10 to pin 16

7	U602's clock	Pulse train of about 268Hz can be measured	On J601, pin 12 to pin 16

Digital Circuitry Checks

Digital control related problems can be checked out by using table 3 listed below. Besides, service personnel can refer to the digital control logic section in "Theory of operation" for more information.

Table 3

Step	Item	Expected Conditions	Comments
1	Power-on self test	LED display should be lit up for 2 seconds after a short beep.	Push down the power button to start the test
2	U202, pin 20	Digital common	When checking GDM-8245's digital control circuits, all the digital signals should be referenced to this digital common.
3	J202 pin 40 to pin 20	+5VDC	+5V power supply for the digital control circuitry
4	U202, pin 19	4MHz clock pulse	Micro controller's 4MHz clock pulse
5	U202, pin 9	Low on power-up, followed by a 300ms High pulse and then returns low	Micro controller's RESET line
6	U202, pin 34	Three-micro-second long positive going pulses	Latching signal for relay control bits, shows up when relay settings is changed
7	U202, pin 36	Three-micro-second long positive going pulse trains	Latching signal for refreshing data bits going to and coming from the front panel
8	U202, pin 14	Pulse stream of around 53Hz	Keep pushing down one of DCV, ACA, MAX/MIN or ▼ buttons
9	U202, pin 15	Pulse stream of around 53Hz	Keep pushing down one of ACV, AC+DC, ▲ or SHIFT buttons

10	U202, pin 16	Pulse stream of around 53Hz	Keep pushing down one of Ω, CAPACITOR, AUTO/MAN buttons
11	U202, pin 17	Pulse stream of around 53Hz	Keep pushing down one of DCA, CONTINUITY or HOLD buttons
12	U202, pin 21 ~ 28	Negative or positive pulse stream of around 268Hz	Control bits going to and coming from the front panel

Key Matrix Checks

Every button on the front panel can be checked by pressing them down one by one to see if a short beep can be heard. Moreover, service personnel can also have the key matrix's function checked by monitoring the waveforms on pin 14 to 17 of U202 according to the descriptions of item 8 to 11 listed in the Digital Circuitry Check table above.

Digital Circuitry Checks

Tables 4 to 14 explain almost all the measurement modes and the ranges' signal paths set by actuating different relays. Service personnel can easily get the information about which scale resistor, relays or shunt resistor should be used for any given measurement mode and range by checking these tables for troubleshooting.

Table 4 DCV Signal Switching

	Range				
Component	500.00mV	5.0000V	50.000V	500.00V	1000.0V
K301	OFF	OFF	OFF	OFF	OFF
K302	ON	OFF	OFF	OFF	OFF
K303	OFF	OFF	OFF	OFF	OFF
K304	OFF	OFF	OFF	OFF	OFF
K305~K310	OFF	OFF	OFF	OFF	OFF
RN301 P3 1.11MΩ		SELECTED			
RN301 P4 101KΩ			SELECTED		
RN301 P5 10KΩ				SELECTED	
RN301 P6 1KΩ					SELECTED
R314 130KΩ	SELECTED				

Table 4 shows which relay is actuated and which voltage-dividing resistor is selected for a given DCV measurement range.

Table 5 ACV Signal Switching

	Range				
Component	500.00mV	5.0000V	50.000V	500.00V	1000.0V
K301	ON	ON	ON	ON	ON
K302	ON	OFF	OFF	OFF	OFF
K303	OFF	OFF	OFF	OFF	OFF
K304	OFF	OFF	OFF	OFF	OFF
K305	ON	OFF	OFF	OFF	OFF
K307~K310	OFF	OFF	OFF	OFF	OFF
RN301 P3 1.11MΩ		SELECTED			
RN301 P4 101KΩ			SELECTED		
RN301 P5 10KΩ				SELECTED	
RN301 P6 1KΩ					SELECTED
R314 130KΩ	SELECTED				

Table 5 shows which relay is actuated and which voltage-dividing resistor is selected for a given ACV measurement range.

Table 6 ACV+DCV Signal Switching

	Range				
Component	500.00mV	5.0000V	50.000V	500.00V	1000.0V
K301	OFF	OFF	OFF	OFF	OFF
K302	ON	OFF	OFF	OFF	OFF
K303	OFF	OFF	OFF	OFF	OFF
K304	OFF	OFF	OFF	OFF	OFF
K305	ON	OFF	OFF	OFF	OFF
K307~K310	OFF	OFF	OFF	OFF	OFF

Table 6 shows which relays are actuated for a given ACV+DCV measurement range.

Table 7 2-Wire Ω Signal Switching

	Range					
Component	500Ω	5kΩ	50kΩ	500kΩ	5MΩ	20MΩ
K301	OFF	OFF	OFF	OFF	OFF	OFF
K302	ON	ON	ON	ON	ON	ON
K303	ON	ON	ON	OFF	OFF	OFF
K304	ON	ON	ON	ON	OFF	OFF
K305~K310	OFF	OFF	OFF	OFF	OFF	OFF
RN301 P2 10MΩ					USED	USED
RN301 P3 1.11MΩ						
RN301 P4 101KΩ			USED			
RN301 P5 10KΩ		USED				
RN301 P6 1KΩ	USED			USED		
R324 1MΩ				USED		

Table 7 shows which relay is actuated and which scale resistor is selected for a given 2-wire Ω measurement range.

Table 8 Capacitor Measurement Signal Switching

	Range				
Component	5.000nF	50.00nF	500.0nF	5.000uF	50.00uF
K301	OFF	OFF	OFF	OFF	OFF
K302	ON	ON	ON	ON	ON
K303	ON	ON	ON	ON	ON
K304	ON	ON	ON	ON	ON
K305~K310	OFF	OFF	OFF	OFF	OFF

Table 8 shows which relays are actuated for a given capacitor measurement range.

Table 9 DCA Signal Switching

	Range					
Component	500uA	5mA	50mA	500mA	2A	20A
K301~K305	OFF	OFF	OFF	OFF	OFF	OFF
K307	OFF	ON	OFF	OFF	OFF	OFF
K308	OFF	OFF	ON	OFF	OFF	OFF
K309	OFF	OFF	OFF	ON	OFF	OFF
K310	OFF	OFF	OFF	OFF	ON	OFF
R301 900Ω Shunt	Selected					
R302 90Ω Shunt	Selected	Selected				
R303 10Ω Shunt	Selected	Selected	Selected			
R305 1Ω Shunt	Selected	Selected	Selected	Selected		

R308 0.1Ω Shunt	Selected	Selected	Selected	Selected	Selected	
20A 0.01Ω Shunt						Selected

Table 9 shows which relay is actuated and which shunt resistor is selected for a given DCA measurement range.

Table 10 ACA Signal Switching

	Range					
Component	500uA	5mA	50mA	500mA	2A	20A
K301~K305	OFF	OFF	OFF	OFF	OFF	OFF
K307	OFF	ON	OFF	OFF	OFF	OFF
K308	OFF	OFF	ON	OFF	OFF	OFF
K309	OFF	OFF	OFF	ON	OFF	OFF
K310	OFF	OFF	OFF	OFF	ON	OFF
R301 900Ω Shunt	Selected					
R302 90Ω Shunt	Selected	Selected				
R303 10Ω Shunt	Selected	Selected	Selected			
R305 1Ω Shunt	Selected	Selected	Selected	Selected		
R308 0.1Ω Shunt	Selected	Selected	Selected	Selected	Selected	
20A 0.01Ω Shunt						Selected

Table 10 shows which relay is actuated and which shunt resistor is selected for a given ACA measurement range.

Table 11 ACA+DCA Signal Switching

	Range					
Component	500uA	5mA	50mA	500mA	2A	20A
K301~K305	OFF	OFF	OFF	OFF	OFF	OFF
K307	OFF	ON	OFF	OFF	OFF	OFF
K308	OFF	OFF	ON	OFF	OFF	OFF
K309	OFF	OFF	OFF	ON	OFF	OFF
K310	OFF	OFF	OFF	OFF	ON	OFF
R301 900Ω Shunt	Selected					
R302 90Ω Shunt	Selected	Selected				
R303 10Ω Shunt	Selected	Selected	Selected			
R305 1Ω Shunt	Selected	Selected	Selected	Selected		
R308 0.1Ω Shunt	Selected	Selected	Selected	Selected	Selected	
20A 0.01Ω Shunt						Selected

Table 11 shows which relay is actuated and which shunt resistor is selected for a given ACA+DCA measurement range.

Table 12 ACV+Hz Signal Switching

	Range			
Component	500mV	5V	50V	500V
K301	ON	ON	ON	ON
K302	ON	OFF	OFF	OFF
K303	OFF	OFF	OFF	OFF
K304	OFF	OFF	OFF	OFF
K305	ON	OFF	OFF	OFF
K307~K310	OFF	OFF	OFF	OFF

Table 12 shows which relay is actuated for a given ACV+Hz measurement range.

Table 13 ACA+Hz Signal Switching

	Range					
Component	500uA	5mA	50mA	500mA	2A	20A
K301~K305	OFF	OFF	OFF	OFF	OFF	OFF
K307	OFF	ON	OFF	OFF	OFF	OFF
K308	OFF	OFF	ON	OFF	OFF	OFF
K309	OFF	OFF	OFF	ON	OFF	OFF
K310	OFF	OFF	OFF	OFF	ON	OFF
R301 900Ω Shunt	Selected					
R302 90Ω Shunt	Selected	Selected				
R303 10Ω Shunt	Selected	Selected	Selected			
R305 1Ω Shunt	Selected	Selected	Selected	Selected		
R308 0.1Ω Shunt	Selected	Selected	Selected	Selected	Selected	
20A 0.01Ω Shunt						Selected

Table 13 shows which relay is actuated and which shunt resistor is selected for a given ACA+Hz measurement range.

Table 14 Open/Short & Diode Measurement Signal Switching

	Mode	
Component	Open/Short	Diode
K301	OFF	OFF
K302	ON	ON
K303	ON	ON
K304	ON	OFF
K305~K310	OFF	OFF

Table 14 shows which relay is actuated for continuity and diode measurements.

CALIBRATION

The Calibration chapter describes how to make sure the instrument is operating properly by calibrating and adjusting its major functions. Please use the Calibration chapter in conjunction with the Calibration log on page 19. The Calibration log can be printed out. After calibration is complete, verification of the specifications should be performed, page 67.

Preparation

⚠ WARNING	Servicing should only be performed by a qualified technician. Before performing calibration, read the *Safety Requirements* and *Precautions Before Use* section. Failure to do so may damage the instrument or result in injury or death.
Note ⚠	In order to ensure performance accuracy, we recommend that all the following items be performed in the order recommended in this manual.
Calibration and verification items	• Operating Voltage- Verification • LED brightness- Verification • Power Supply- Verification • ACV Frequency Response- Verification & Adjustment • Resistance Range Verification- Calibration • Diode- Adjustment • Capacitance- Adjustment • DCA- Adjustment • ACA- Adjustment • DCV- Adjustment • Resistance Ranges Shorting- Verification • Resistance Range- Verification • Diode- Verification • Capacitance Short- Verification • Capacitance- Verification • DCA Short- Verification • DCA- Verification • ACA- Verification • ACV- Short Verification • ACV- Verification • AC+DC- Verification • DCV Short- Verification • DCV- Verification • DCV- Verification (dB) • Buzzer Test • Frequency- Verification (AC+Hz)
When to Run Calibration and Verification	• When using the instrument in a new environment • After replacing one of the major internal modules, such as the front panel or instrument PCB • To check whether the instrument is malfunctioning or not

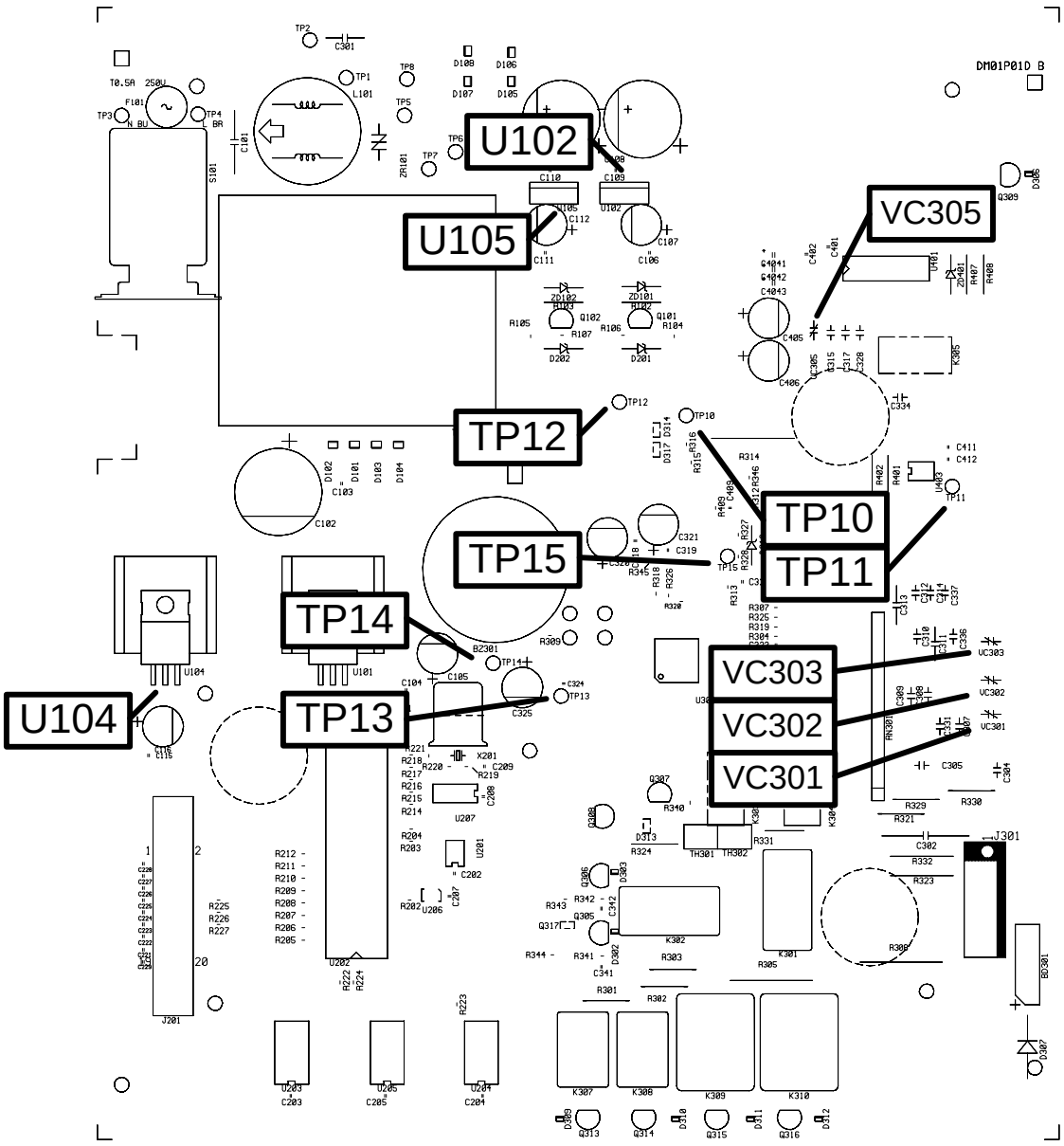
Calibration and Verification Environment	• Location: Indoor, no direct sunlight, dust free • Relative Humidity: 70% • Temperature: +18°C~+28°C • Warm-up time: ≥ 30 minutes
Calibration procedure	1. Calibrate an item and record the result into the log (page19). 2. If the result does not meet the accepted range, adjust the item if an adjustment procedure exists. 3. If the adjustment does not resolve the problem or the adjustment procedure does not exist, send the instrument back to the factory for repair. 4. After Calibration, use the Verification chapter to verify the calibration is within specification.

List of Equipment

Here is the list of all equipment used in the service operations.

Item	Requirements	Recommended
Multimeter	• Operating voltage verification, Power supply verification	• GDM-8145/825XA
DMM calibrator	• ACV frequency response calibration and adjustment, capacitance, resistance, diode, DCA, ACA, DCV and ACV calibration and verification	• FLUKE 5500A/5520A/9100 (with the same specifications or greater)
Standard capacitance	• Capacitance calibration and verification	• GW standard capacitance fixture

Component Position (Servicing)



For the location of other components not related to verification and adjustment, please see the circuit diagram on page 93.

Entering the Calibration mode

Background

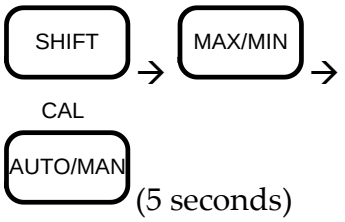
When asked to enter a calibration mode on the GDM-8245, please follow the procedure below. There are a number of calibration modes shown in the table below.

Calibration Modes

Mode	Description
CL10	ACV – short calibration
CL20	DCV/ACA/DCA/Ω - short calibration
CL30	Capacitance -open calibration
CL40	400mΩ -short calibration
CL50	Main calibration and adjustment mode

Enter the calibration mode

1. Turn on the instrument.
2. Press Shift, Max/Min and then hold the Auto/Man key for 5 seconds until the calibration mode appears.



3. CL 10 will be shown in the secondary display.

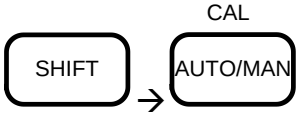
Navigation

To move to the next calibration mode press the UP arrow key.

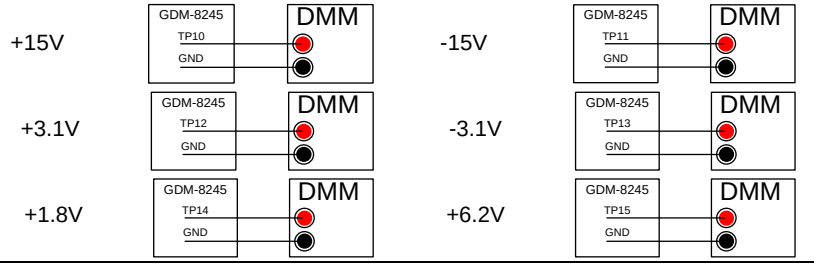
Note: It is not possible to navigate to the previous calibration mode. Pressing down will have no effect.

To return to the first calibration mode (CL 10), press SHIFT then the UP arrow key.

To exit the calibration mode, press SHIFT and the Auto/Man key.



Voltage Verification

Accepted range	+15V±0.5V, -15V±0.5V, +3.1V±0.2V, -3.1V±0.2V, +1.8V±0.2V, +6.2V±0.2V
Equipment	• DMM • Test leads
Configurations	

Verification procedure

Remove the top case. Page 86. Remove the RF shield on the main board.

1. Turn on the instrument.
2. Measure the voltage between TP10 and ground.

   Range +15V±0.5V.
3. Measure the voltage between TP11 and ground.

   Range -15V±0.5V.
4. Measure the voltage between TP12 and ground.

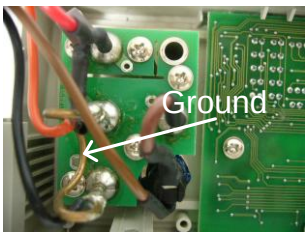
   Range +3.1V±0.2V.
5. Measure the voltage between TP13 and ground.

   Range -3.1V±0.2V.
6. Measure the voltage between the TP14 and ground.

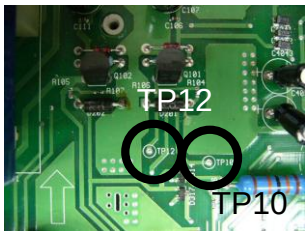
   Range +1.8V±0.2V.
7. Measure the voltage between TP15 and ground.

   Range +6.2V±0.2V.

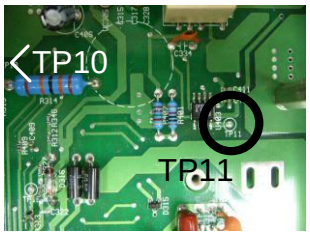
Ground (COM terminal)



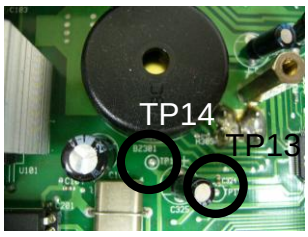
Test points 10~15



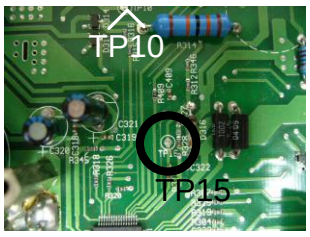
TP12, TP10



TP11



TP13, TP14



TP15

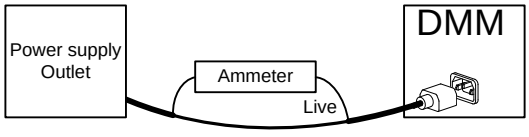
Voltage verification is complete

LED Verification

Accepted range	Visual inspection
Equipment	• N/A
Verification procedure	Visually inspect that all LED indicators turn on briefly when the instrument is turned on.

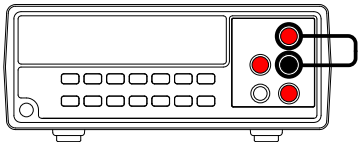
Led verification is complete

Power Supply Current Verification

Accepted range	45mA±5mA (115V input) 22mA±5mA (230V input)
Equipment	• Ammeter • Test leads
Configurations	
Verification procedure	1. Connect an ammeter in series to the live wire. 2. Turn on the machine and measure the current. 3. Range 115V input 45mA±5mA, 230V input 22mA±5mA

ACV, ACA, DCA, Ω Short Calibration

Accepted range	< 3 digits (all ranges)
Equipment	• Test leads
Configurations	• GDM-8245: 500mV, 5V, 50V, 500V, 1000V

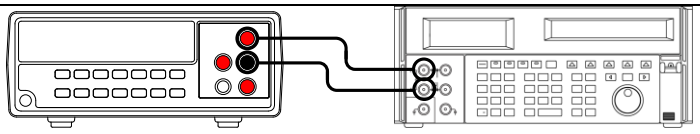


Verification procedure	1. Enter CL10 calibration mode (ACV short). 2. Short the V and COM input terminals. 3. Press the Auto/Man key. The secondary display will show CL11. 4. The instrument will automatically perform a short calibration for all ACV ranges. After approximately 40 seconds, the secondary display will show CL10 again, indicating the ACV short calibration is complete. 5. Press the Up arrow to enter CL20 calibration mode (DCV, ACA, DCA, Ω). 6. Repeat steps 3~4 for the CL20 mode. Approx. 130 seconds. 7. Press Up twice to enter CL40 mode (400mΩ short). 8. Repeat steps 2~4 for the CL40 mode. Approx. 180 seconds.

ACV, ACA, DCA, Ω (shorting) verification is complete.

Frequency Response Calibration

Accepted range	± 4 digits (all ranges)
Equipment	• Multimeter calibrator • Test leads
Configuration	



Caution	The following service procedure involves the use of high voltages. Ensure proper precautions and correct safety measures are adhered to.

Verification procedure

1. Enter CL50 Calibration mode.
2. Set the DMM mode to AC mV. Press Shift + ACV.
3. Input 200mV/50Hz to the DMM.
4. Check the DMM display. If the voltage is within specification range, go to the next calibration range.
   Range: 200mV±4 digits
5. Press Auto/Man to re-calibrate the range. Press Auto/Man again to save when the calibration has settled.
6. Enter AC+DC mode. Press the AC+DC key.
7. Check the DMM display. If the voltage is within specification, go to the next calibration range.
   Range: 200mV±4 digits
8. Press Auto/Man to re-calibrate the range. Press Auto/Man again to save when the calibration has settled.
9. Enter ACV 5V range. Press the ACV key.
10. Input 2V/ 50Hz.
11. Check the DMM display. If the voltage is within specification, go to the next calibration range.
    Range: 2V±4 digits
12. Press Auto/Man to re-calibrate the range. Press Auto/Man again to save when the calibration has settled.
13. Repeat steps 9 to 12 for the following inputs and ranges.

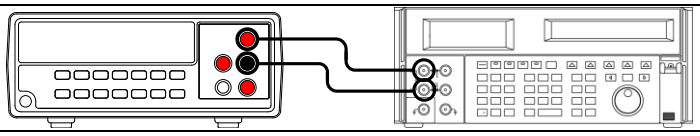
Range	Input	Specification
50V	20V/50Hz	20V±4 digits
500V	200V@50Hz	200V±4 digits

1kV	1000V@50Hz	1000V±4 digits

Note: The Up and Down arrow keys can be used to change the DMM range up and down.

Calibrating the frequency response is complete.

Frequency Response Adjustment

Accepted range	±10 digits (all ranges excluding 1kV)
Equipment	• Multimeter calibrator • Test leads
Configuration	
Caution	The following service procedure involves the use of high voltages. Ensure proper precautions and correct safety measures are adhered to.

Verification procedure

1. Enter CL50 Calibration mode.
2. Set the DMM mode to AC mV. Press Shift + ACV.
3. Input 200mV/50kHz.
4. Check the DMM display. If the voltage is within the specification range, go to the next adjustment range. If not, adjust variable capacitor VC305 until the voltage is within specification.

   Range: 200.50mV±10 digits
5. Set the DMM to ACV mode, 5V range.
6. Input 4.9V/10kHz.
7. Check the DMM display. If the voltage is within the specification range, go to the next adjustment range. If not, adjust variable capacitor VC301 until the voltage is within specification.

   Range: 4.9V±10 digits
8. Press Up to set the DMM range to 50V.
9. Input 49V/10kHz.

10. Check the DMM display. If the voltage is within the specification range, go to the next adjustment range. If not, adjust variable capacitor VC302 until the voltage is within specification.

    Range: 49V±10 digits

11. Press Up to set the DMM range to 500V.

12. Input 490V/1kHz.

13. Check the DMM display. If the voltage is within the specification range, go to the next adjustment range. If not, adjust variable capacitor VC303 until the voltage is within specification.

    Range: 490V±10 digits

14. Press Up to set the DMM range to 1kV.

15. Input 1kV/1kHz.

16. Check the DMM display. Range: 1kV±20 digits

Note

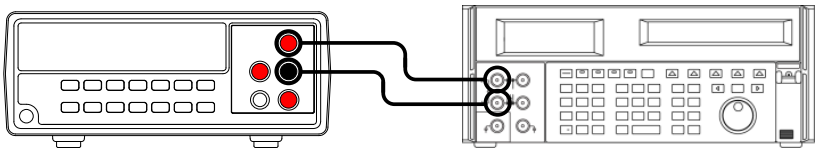
There is no adjustment procedure for the GDM-8245 for the 1kV range. If the voltage is not within specification at 1kHz, a lower frequency (50Hz) can be used to downward calibrate the DMM. After the downward calibration, the 1kHz frequency can then be tested again.

Calibrating the frequency response is complete.

Capacitance Calibration (Open)

Accepted range	N/A
Equipment	• N/A
Configurations	• GDM-8245: CL30 calibration mode
Verification procedure	1. Enter CL30 Calibration mode. 2. Press the Auto/Man key. The secondary display will show CL31. 3. The instrument will automatically perform an open calibration for all capacitance ranges. After approximately 50 seconds, the secondary display will show CL30 again, indicating the capacitance open calibration is complete.
Capacitance calibration (open) is complete	

Resistance Calibration

Accepted range	±3 digits (all ranges, 19MΩ±40 digits for 20MΩ range)
Equipment	• Resistance calibrator • Test leads
Configurations	• Resistance Calibrator: 400Ω, 4kΩ, 40kΩ, 400kΩ, 3MΩ, 9.907MΩ, 19MΩ • GDM-8245 Range: 500Ω, 5kΩ, 50kΩ, 500kΩ, 5MΩ, 20MΩ 
Verification procedure	1. Enter CL50 Calibration mode. 2. Press Ω key to enter Resistance mode. (Range: 500 Ω) 3. Input 0Ω to the DMM. 4. Press SHIFT + REL to negate the resistance of the test lead cables.

Note (Do not set the calibrator output to standby after REL is pressed else the test lead resistance will not be compensated.)

5. Input a 400Ω resistance.
6. Check the DMM display. If the resistance is within specification, go to the next calibration range.

   Range: 400Ω±3 digits
7. Press Auto/Man to re-calibrate the range. The mode will change to CL51. Press Auto/Man again to save when the calibration has settled. The mode will return to CL50.
8. Repeat steps 5 to 8 for the following inputs and ranges.

Range	Input	Specification
5kΩ	4kΩ	4kΩ±3
50kΩ	40kΩ	40kΩ±3
500kΩ	400kΩ	400kΩ±3
5MΩ	3MΩ	3MΩ±3
20MΩ	9.907MΩ	9.912MΩ±3*
20MΩ	19MΩ	19MΩ±40

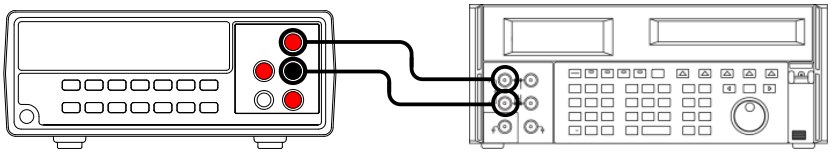
*For the 9.907 MΩ input, a reading of 9.912 ±3 MΩ is required.

Note The Up and Down arrow keys can be used to change the DMM resistance range up and down.

Resistance calibration is completed.

DCV Calibration

Accepted range	± 3 digits (all ranges)
Equipment	• Multimeter calibrator • Test leads
Configurations	• GDM-8245: 500mV, 5V, 50V, 500V, 1000V • Calibrator: 400mV, 4V, 40V, 400V, 1000V



Verification procedure

1. Enter CL50 Calibration mode.
2. Set the mode to DC mV mode. Press SHIFT + DCV.
3. Input 400mV.
4. Check the DMM display. If the voltage is within specification, go to the next calibration range.

   Range: 400mV±3 digits
5. Press Auto/Man to re-calibrate the range. The mode will change to CL51. Press Auto/Man again to save when the calibration has settled. The mode will return to CL50.
6. Set the mode to DCV. Press DCV.
7. Repeat steps 3 to 6 for the following inputs and ranges.

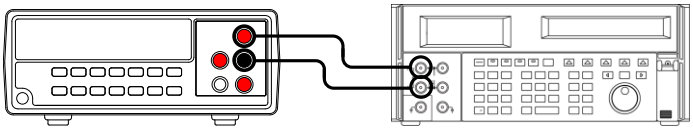
Range	Input	Specification
5V	4V	4V±3
50V	40V	40V±3
500V	400V	400V±3
1000V	1000V	1000V±3

Note

The Up and Down arrow keys can be used to change the DMM DCV range up and down.

DCV calibration is complete

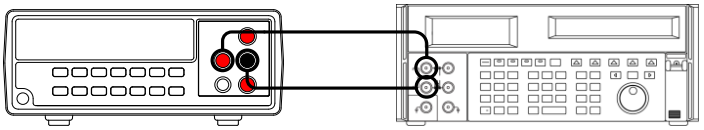
Diode Calibration

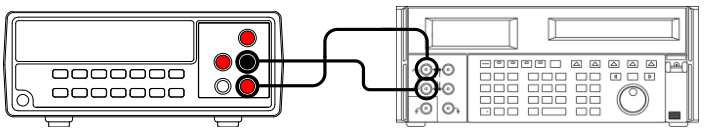
Accepted range	N/S
Equipment	• Multimeter calibrator • Test leads
Configurations	• Calibrator: 0.537V, 0.937V • GDM-8245 Range: Diode mode 
Verification procedure	1. Enter CL50 Calibration mode. 2. Set the mode to Diode. Press SHIFT + •)). 3. Input 0.537V. 4. Check the DMM display. If the voltage is within the reading range, go to the next calibration range. Reading range: approx. 0.6616V 5. Press Auto/Man to re-calibrate the range. The mode will change to CL51. Press Auto/Man again to save when the calibration has settled. The mode will change to CL52. 6. Repeat steps 3 to 5 with an input of 0.937V and a reading range of 1V. 7. The mode will return to CL50.

Diode calibration is complete

DCA Calibration

Accepted range	0±3 digits (all ranges)
Equipment	• Multimeter calibrator • Test leads
Configurations	• GDM-8245: 500uA, 5.0mA, 50mA, 500mA, 2A, 20A • Calibrator: 400uA, 4.0mA, 40mA, 400mA, 2A, 8A


≤2A


<20A

Verification procedure	1. Enter CL50 Calibration mode.
Note	Ensure the correct current terminal is used for each range.

2. Set the DMM to DCA mode. Press DCA. Ensure the range is set to 500uA.
3. Input 400uA.
4. Check the DMM display. If the current is within specification, go to the next calibration range.

   Range: 400uA±3 digits
5. Press Auto/Man to re-calibrate the range. The mode will change to CL51. Press Auto/Man again to save when the calibration has settled. The mode will return to CL50.
6. Repeat steps 2 to 6 for the following inputs and ranges.

Range	Input	Specification
5mA	4mA	4mA±3
50mA	40mA	40mA±3
500mA	400mA	400mA±3

2A	2A	2A±3
20A*	8A	8A±3

*Press SHIFT+DCA to enter the 20A range.

Note The Up and Down arrow keys can be used to change the DMM DCA range up and down.

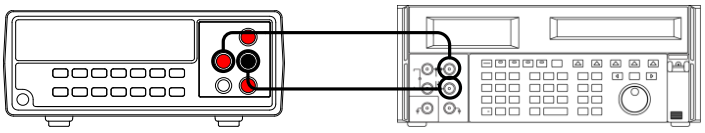
DCA calibration is complete

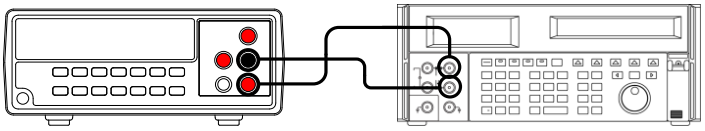
ACA Calibration

Accepted range ± 4 digits (all ranges)

Equipment
- Multimeter calibrator
- Test leads

Configurations
- GDM-8245: 500uA, 5.0mA, 50mA, 500mA, 2A, 20A
- Calibrator: 200uA/70Hz, 2.0mA/70Hz, 20mA/70Hz, 200mA/70Hz, 2A/50Hz, 8A (Display 8.010A)/400Hz


≤2A


<20A

Verification procedure

1. Enter CL50 Calibration mode.

Note Ensure the correct current terminal is used for each range.

2. Set the DMM to ACA mode. Press ACA. Ensure the range is set to 500uA.
3. Input 200uA/70Hz.
4. Check the DMM display. If the current is within specification, go to the next calibration range.

   Range: 200uA±4 digits

5. Press Auto/Man to re-calibrate the range. The mode will change to CL51. Press Auto/Man again to save when the calibration has settled. The mode will return to CL50.

6. Repeat steps 2 to 6 for the following inputs and ranges.

Range	Input	Specification
5mA	2mA/70Hz	2mA±4
50mA	20mA/70Hz	20mA±4
500mA	200mA/70Hz	200mA±4
2A	2A/50Hz	2A±4
20A*	8A/400Hz	Reading of 8.010A±4

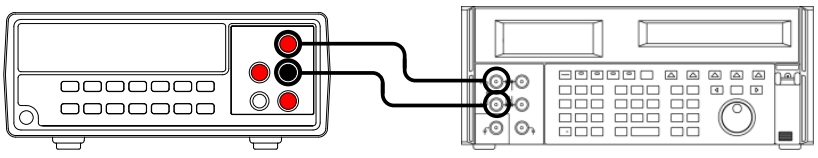
*Press SHIFT + ACA to enter the 20A range

Note	The Up and Down arrow keys can be used to change the DMM ACA range up and down.
Note	Ensure the correct terminal is used for each range.

ACA calibration is complete

Capacitance Calibration

Accepted range	±3 digits for all ranges
Equipment	• Capacitor calibrator • Test leads
Configurations	• GDM-8245: 5nF, 50nF, 500nF, 5uF, 50uF • Multimeter Calibrator: 30nF, 300nF, 3uF, 30uF • Standard capacitance: 3.282nF



Verification procedure	1. Enter CL50 Calibration mode.

2. Set the DMM to ⊣⊱ mode. Press ⊣⊱. Ensure the range is set to 5nF.
3. Input 3.282nF capacitance.
4. Check the DMM display. If the capacitance is within specification, go to the next calibration range.

   Range: 3.282nF±3 digits
5. Press Auto/Man to re-calibrate the range. The mode will change to CL51. Press Auto/Man again to save when the calibration has settled. The mode will return to CL50.
6. Repeat steps 2 to 6 for the following inputs and ranges.

Range	Input	Specification
50nF	30nF	30nF±3
500nF	300nF	300nF±3
5uF	3uF	3uF±3
50uF	30uF	30uF±3

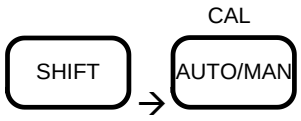
Note: The Up and Down arrow keys can be used to change the DMM capacitance range up and down.

ACA calibration is complete

Exit Calibration Mode

Exit procedure

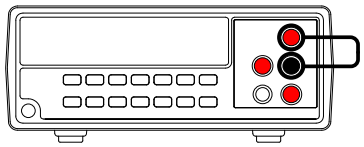
1. To exit the calibration mode, press SHIFT and the Auto/Man key.



VERIFICATION

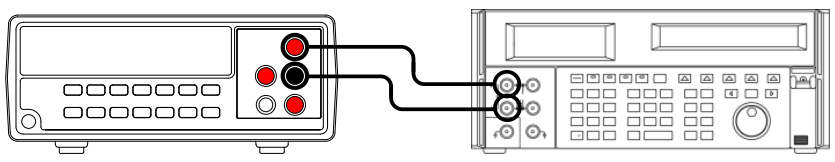
The Verification chapter describes how to make sure the instrument is operating properly by verifying its major functions after calibration. Verification is intended as a full performance inspection. Please use the Verification chapter in conjunction with the Verification log on page 23. The verification log can be printed out.

Resistance Verification (Short)

Accepted range	Shorting (500Ω range ±3 digits, other ranges ±2 digits)
Equipment	• Test leads
Configurations	• GDM-8245 Range: 500Ω, 5kΩ, 50kΩ, 500kΩ, 5MΩ, 20MΩ 
Verification procedure	1. Set the GDM-8245 range to 500Ω. 2. Short the test leads. Verify the resistance as 0±3 digits. 3. Repeat steps 1 and 2 for the remainder of the ranges. Verify the resistance as 0±2 digits.

Resistance shorting verification is complete.

Resistance Verification

Accepted range	(Digits): (1Ω ±4, 100Ω±11, 490Ω±37, 4.9kΩ±36, 49kΩ±36, 490kΩ±36, 4.9MΩ±70, 19MΩ±41.
Equipment	• Multimeter calibrator • Test leads
Configurations	• Multimeter Calibrator: 1Ω, 100Ω, 490Ω, 4.9kΩ, 49kΩ, 490kΩ, 4.9MΩ, 19MΩ • GDM-8245 Range: 500Ω, 5kΩ, 50kΩ, 500kΩ, 5MΩ, 20MΩ 
Verification procedure	1. Set the GDM-8245 range to 500Ω. 2. Input 0Ω to the DMM.

3. Press SHIFT + REL to negate the resistance of the test lead cables.

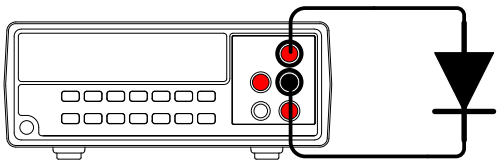
Note (Do not set the calibrator output to standby after REL is pressed else the test lead resistance will not be compensated.)

4. Apply a resistance of 1Ω (standard resistor reference) to the GDM-8245. 1Ω±4 digits.

5. Repeat steps 1 and 2 for the remaining ranges and resistances.

Resistance verification is complete.

Diode Verification

Accepted range	N/A
Equipment	• Diode fixture
Configurations	• GDM-8245 Range: Diode mode 
Verification procedure	1. Set the multimeter to diode mode. 2. Connect the fixture as shown. A voltage between .5V~.7V should be shown. 3. Reverse the polarity of the connection. OL (overload) should be displayed on the DMM.

Diode verification is complete.

Capacitance Verification (Open)

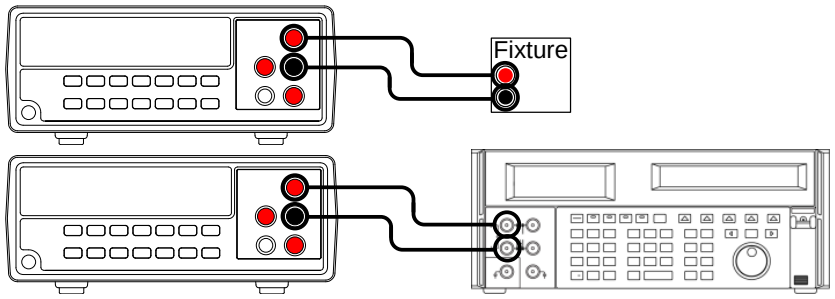
Accepted range	±3 digits for 5nf range; ±2 digits for all other ranges
Equipment	N/A
Configurations	• GDM-8245: 5nF, 50nF, 500nF, 5uF, 50uF

Verification procedure	1. Set the DMM to capacitance mode. Set the range to 5nF. Open terminals. Verify the results. 2. Repeat the procedure for all other ranges.

Capacitance verification (open) is complete

Capacitance Verification

Accepted range	(Digits): 1.006nF±28, 49nF±76, 490nF±71, 4.9uF±71, 49uF±71
Equipment	• Multimeter • Test leads • calibrator/fixure
Configurations	• GDM-8245: 5nF, 50nF, 500nF, 5uF, 50uF • Capacitor calibrator/fixture: 1.006nF, 49nF, 490nF, 4.9uF, 49uF

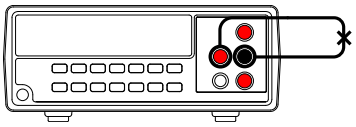


Verification procedure	1. Set the range to 5nF. Input 1.006nF. Verify the capacitance is 1.006nF±28. 2. Repeat the procedure for the rest of the ranges.

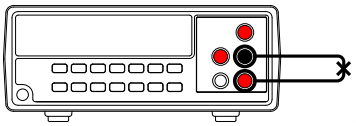
Capacitance verification is complete

DCA Verification (Short)

Accepted range	±3 digits all ranges
Equipment	• Test leads
Configurations	• GDM-8245 range: 500uA, 5.0mA, 50mA, 500mA, 2A, 20A



≤2A range



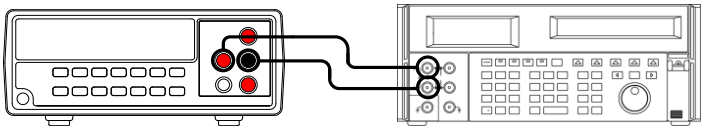
20A range

Calibration procedure	1. Set the range to 500uA (DCA mode). 2. Short the input terminals. Verify the results. 3. Repeat the procedure for the remainder of the ranges; 5.0mA~20A (DCA, DC 20A). Note: Ensure the correct terminal is used for each range.

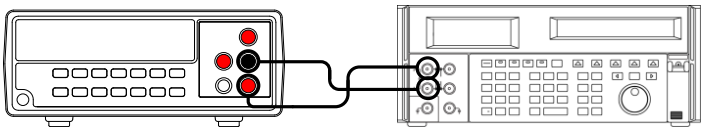
DCA Verification (short) is complete

DCA Verification

Accepted range	(Digits): 490uA±70, 4.9mA±70, 49mA±70, 490mA±70, 1.9A±41, 19A*±41
Equipment	• Multimeter calibrator • Test leads
Configurations	• GDM-8245: 500uA, 5.0mA, 50mA, 500mA, 2A, 20A • Calibrator: 490uA, 4.9mA, 49mA, 490mA,1.9A, 19A*



<2A



<20A*

*Do not input 19A for more than 1 second. Exceeding 1 second may blow the fuse.

Calibration procedure	1. Set the range to 500uA. 2. Input 490uA. Verify a DC current of 490uA±70 digits.

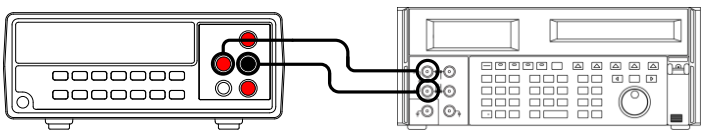
3. Repeat the procedure for the remainder of the ranges (5.0mA~20A).

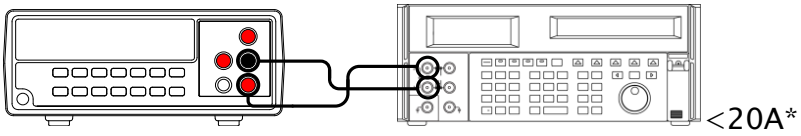
   Note: Ensure the correct terminal is used for each range.

DCA Verification is complete

ACA Verification

Accepted range	(Digits): 490uA(20Hz)<378; 490uA(2kHz)<195; 490uA(20kHz)<746 4.9mA(20Hz)<378; 4.9mA(2kHz)<195; 4.9mA(20kHz)<746 49mA(20Hz)<378; 49mA(2kHz)<195; 49mA(20kHz)<746 490mA(20Hz)<378; 490mA(400Hz)<195; 490mA(2kHz)<195 1.9A(20Hz)<153; 1.9A(400Hz)<82; 1.9A(2kHz)<82 19A*(20Hz)<153; 19A*(400Hz)<82; 19A*(2kHz)<82
Equipment	• Multimeter calibrator • Test leads
Configurations	• GDM-8245: 500uA, 5.0mA, 50mA, 500mA, 2A, 20A • Calibrator: 490uA/20Hz/2kHz/20kHz, 4.9mA/20Hz/2kHz/20kHz, 49mA/20Hz/2kHz/20kHz, 490mA/20Hz/400Hz/2kHz, 1.9A/20Hz/400Hz/2kHz, 19A* /20Hz/400Hz/2kHz
Calibration procedure	1. Set the range to 500uA (ACA) on the GDM-8245. 2. Input 490uA/20Hz. Verify 490uA(20Hz)<378





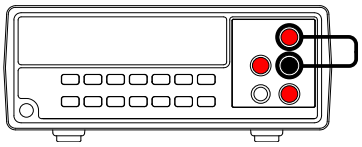
*Do not input 19A for more than 1 second. Exceeding 1 second may blow the fuse.

3. Repeat for the remaining frequencies and ranges*.

   Note: Ensure the correct terminal is used for each range.

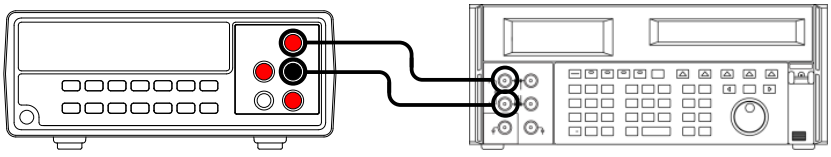
Specification verification is complete

ACV Verification (Short)

Accepted range	< 3 digits (all ranges)
Equipment	• Test leads
Configurations	• GDM-8245: 500mV, 5V, 50V, 500V, 1000V
	
Verification procedure	1. Set the range to 500mV (AC mV). 2. Short the input terminals. Verify the results. 3. Repeat for the remaining ranges (AC mV and ACV).

ACV (shorting) verification is complete

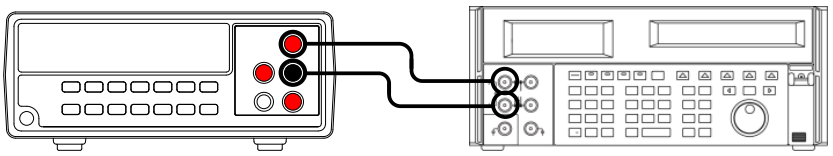
ACV Verification (Part 1)

Accepted range	(Digits): 490mV(20Hz)<353; 490mV(2kHz)<182; 490mV(10kHz)<353; 490mV(20kHz)<707; 490mV(50kHz)<1736
Equipment	• Multimeter calibrator • Test leads
Configurations	• GDM-8245: 500mV • Calibrator: 490mV/20Hz/2kHz/10kHz/20kHz/50kHz
	
Verification procedure	1. Set the range to 500mV (GDM-8245). 2. Input 490mV/20Hz. Verify the results.

3. Repeat for the remaining frequencies.

ACV verification (part 1) is complete

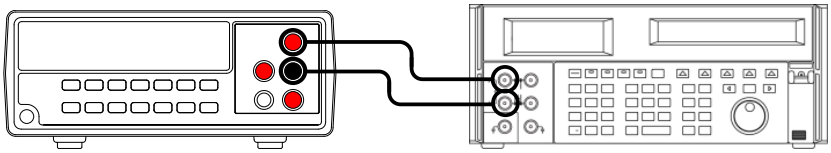
AC+DC Verification

Accepted range	(Digits): 200mV(50kHz)<721 (AC + DC)
Equipment	• Multimeter calibrator • Test leads
Configurations	• GDM-8245: 500mV range (AC+DC) • Calibrator: 200mV/50kHz
	
Verification procedure	1. Set the range to 500mV (AC+DC) 2. Input 200mV/50kHz.Verify the results.

AC+ DC verification is complete

ACV Verification (Part 2)

Accepted range	(Digits): 4.9V(20Hz)<353; 4.9V(2kHz)<182; 4.9V(10kHz)<353; 4.9V(20kHz)<707; 4.9V(50kHz)<1736 49V(20Hz)<353; 49V(2kHz)<182; 49V(10kHz)<353; 49V(20kHz)<707; 49V(50kHz)<1736 490V(40Hz)<353; 490V(1kHz)<182 1000V(40Hz)<80; 1000V(1kHz)<45 800V(40Hz)<66; 800V(1kHz)<38
Equipment	• Multimeter calibrator • Test leads
Configurations	• GDM-8245: 5V, 50V, 500V, 1000V • Calibrator: 4.9V/20Hz/2kHz/10kHz/20kHz/50kHz, 49V/20Hz/2kHz/10kHz/20kHz/50kHz, 490V/40Hz/1kHz, 1000V/40Hz/1kHz, 800V/40Hz/1kHz

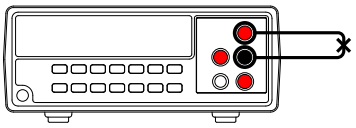


Verification procedure	1. Set the range to 5V (GDM-8245). 2. Input 4.9V/20Hz. Verify the results. 3. Repeat for the remaining ranges and frequencies.
Note	There is no adjustment point for the 1kV range. However, the 1kV/50Hz range can be downward calibrated. After the downward calibration, the 1kHz frequency can then be tested again.

ACV verification (Part 2) is complete

DCV Verification (Short)

Accepted range	1000V ± 7 digits, all other ranges ± 3 digits
Equipment	• Test leads
Configurations	• GDM-8245 range: 500mV, 5V, 50V, 500V, 1000V

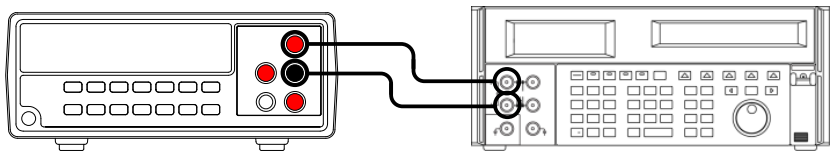


Verification procedure	1. Set the range to 500mV (DC mV). 2. Short the terminals. Verify the results. 3. Repeat for the remaining ranges (DCV mode).

DCV Verification (short) is complete

DCV Verification (Part 1)

Accepted range	(Digits): +490mV±14, -490mV±14, 4.9V±14
Equipment	• Multimeter calibrator • Test leads
Configurations	• GDM-8245: 500mV, 5V • Calibrator: -490mV, +490mV, 4.9V

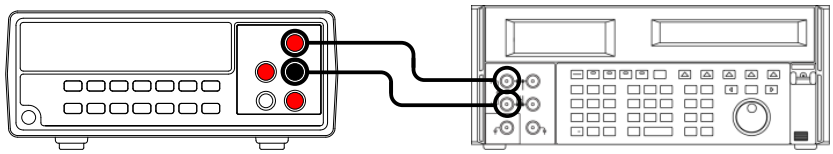


Verification procedure	1. Set the range to 500mV (DCV). 2. Input 490mV DC. Verify the results. 3. Repeat for -490mV and 4.9V DC (5V range).

DCV verification (Part 1) is complete

DCV Verification (dBm)

Accepted range	(Digits): 16.02 dBm ± 3
Equipment	• Multimeter calibrator • Test leads
Configurations	• GDM-8245: 5V (DCV → dBm) • Calibrator: 4.9V DC

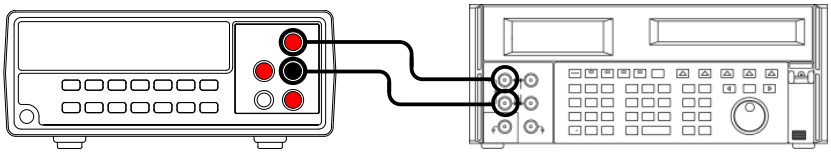


Verification procedure	1. Set the range to 5V (DCV). 2. Input 4.9V DC. Press the dBM button. Verify the results.

DCV verification (dBm) is complete

DCV Verification (Part 2)

Accepted range	(Digits):-4.9V±14, +49V±14, -49V±14, +490V±14, -490V±14, +1000V±9, -1000V±9
Equipment	• Multimeter calibrator • Test leads
Configurations	• GDM-8245 range: 5V, 500V, 1000V • Calibrator: -4.9V, ±49V, ±490V, ±1000V

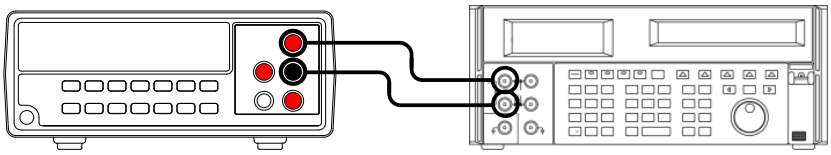


Verification procedure	1. Set the range to 5V (DCV). 2. Input -4.9V DC. Verify the results. 3. Repeat for the remaining ranges and voltages.

DCV Verification (part 2) is complete

Beeper Test

Accepted range	>7Ω, buzzer off; <5Ω, buzzer on
Equipment	• Multimeter calibrator • Test leads
Configurations	• GDM-8245: Beeper mode • Calibrator: 5Ω, 7Ω

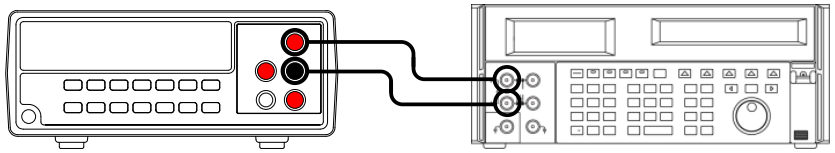


Verification procedure	1. Set the mode to beeper. 2. Set the calibrator to 5Ω. Verify the beeper sounds. 3. Set the calibrator to 7Ω. Verify the beeper does not sound.

Beeper verification is complete

Frequency Measurement Verification

Accepted range	200kHz ±2digits at 1.1V.
Equipment	• Multimeter calibrator • Test leads
Configurations	• GDM-8245 range: AC+Hz mode • Calibrator: 1.1V/200kHz



Verification procedure	1. Set the mode to ACV, 5V range. 2. Set the mode to AC+Hz. 3. Input 1.1V/200kHz. Verify the results.
Note	The primary display will not show a voltage reading with a frequency of 200kHz

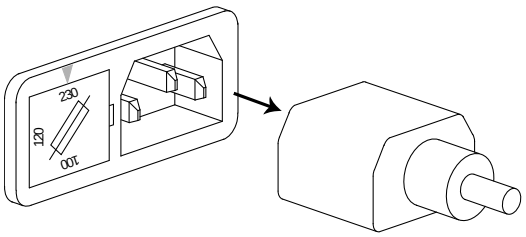
Frequency Measurement Verification is complete

CHANGING THE AC MAINS / FUSE

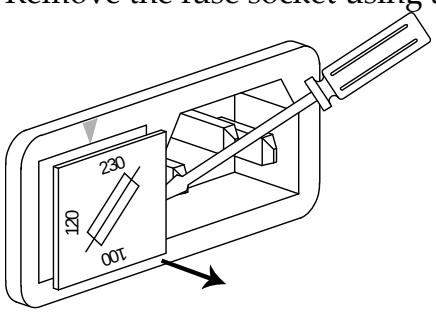
Changing the Fuse ⚠ WARNING	Before replacing the fuse, make sure the cause of fuse blowout has been fixed. Before replacing the fuse, ensure the power cord has been disconnected from mains power. Failure to do so may result in injury or death.

Steps

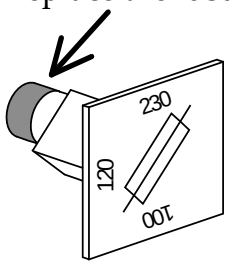
1. Remove the power cord.



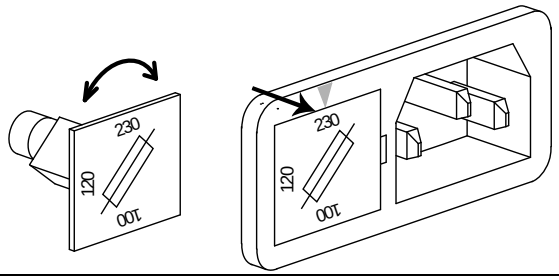
1. Remove the fuse socket using a flat screwdriver.



2. Replace the fuse in the holder.



3. Ensure the correct line voltage is lined up with the arrow on the fuse holder. Insert the fuse socket.

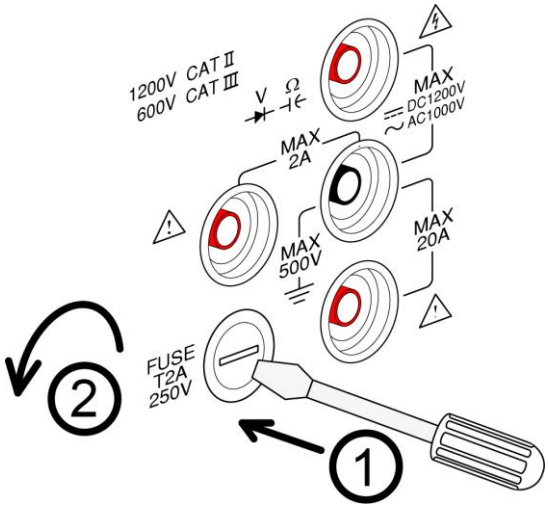


Rating	100V/120V	T0.1A 250V
	230V	T0.08A 250V

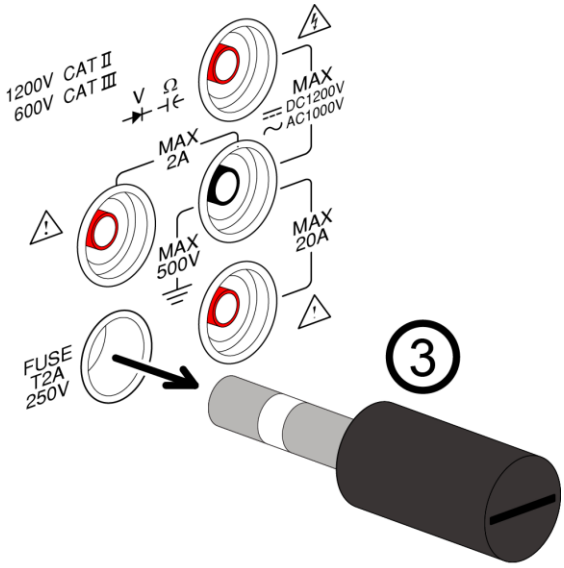
Replace the Input Current Fuse

Step

1. Press the fuse holder with a flat screwdriver.
2. Turn anticlockwise.



3. Remove the fuse assembly. Replace the fuse at the end of the holder.



Rating

T2A, 250V

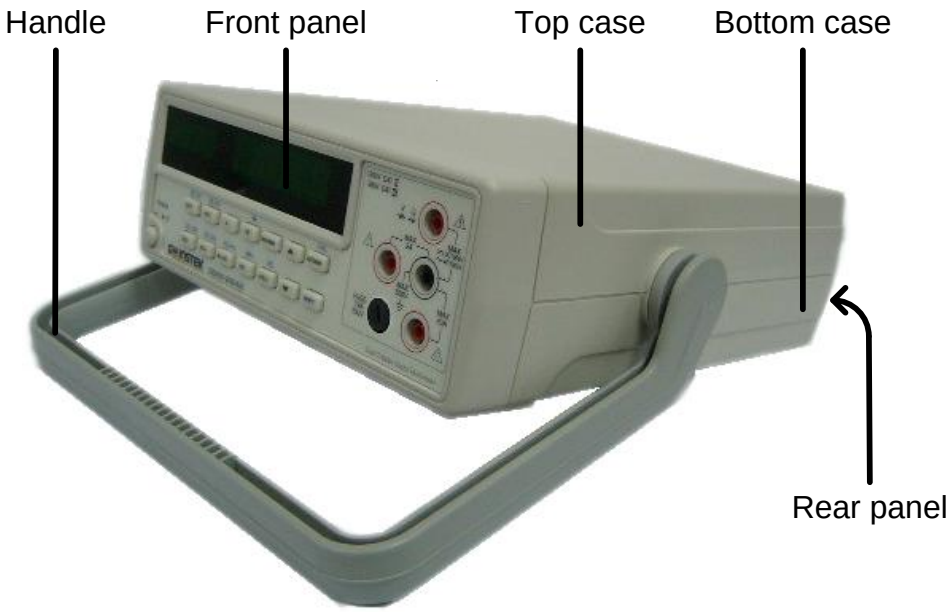
REPLACEABLE PARTS AND DISASSEMBLY

The Replacement Parts and Disassembly chapter lists the replaceable mechanical components of the GDM-8245 and shows how to remove the PCBs, panels, and outer casing from the instrument. The procedures described in this chapter are intended for parts replacement and board adjustment. The PCB diagrams included in *Circuit Diagrams and Components Parts* chapter (page92) shows more detail about the electrical components of the instrument and thus can also be used as a reference.


WARNING

Before disassembling the instrument, disconnect the power cord from live voltage sources. Failure to do so may result in injury or loss of life.

External View



Disassembly

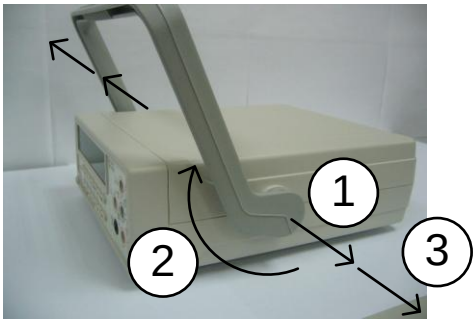
Disassembly Equipment

Here is the list of all equipment used during disassembly.

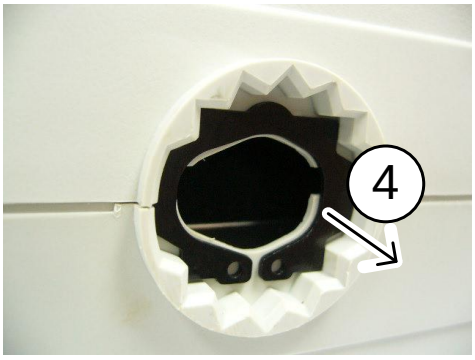
Item	Requirements	Used in
• Phillips screwdriver • Flathead screwdriver	• Various sizes	• Adjustments • Disassembly

Outer Casing

1. Pull the handle base out slightly
2. Turn the handle until it is in the upright position.
3. Pull the handle bases out from DMM case.

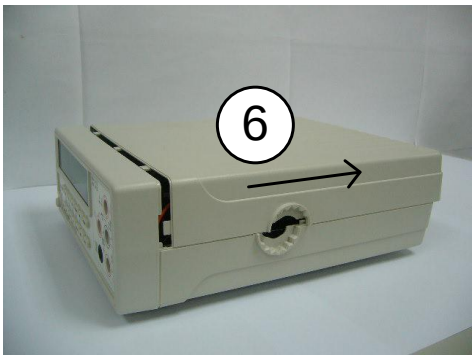


4. Remove the handle fixtures from the case insert.

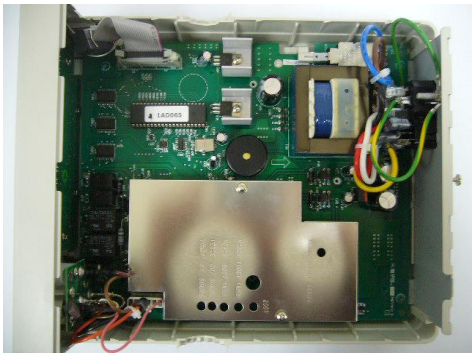


5. Remove the screw from the rear panel.

6. Slide the top case off and remove.



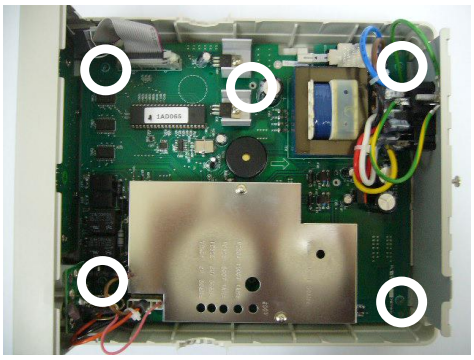
7.



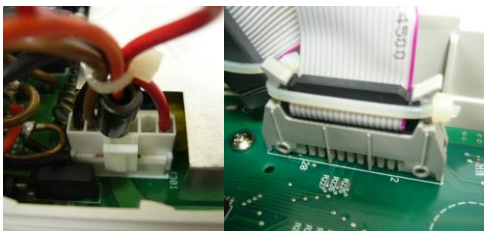
Disassembling the top outer casing is complete. Reverse the procedure to re-assemble.

Main PCB and Front/Rear/Bottom Panel Removal

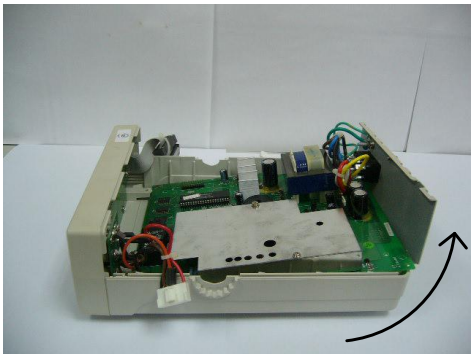
1. Remove the outer casing. Page 86
2. Remove the 5 screws holding the main PCB to the bottom case.



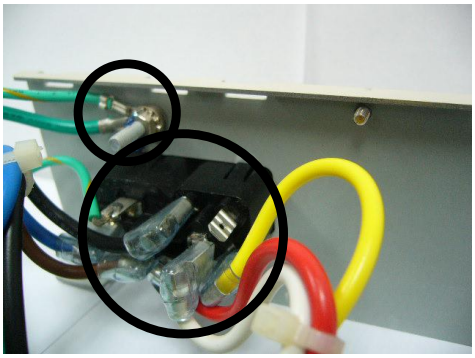
3. Remove the terminal connector the ribbon cable coming from the front panel PCBs.



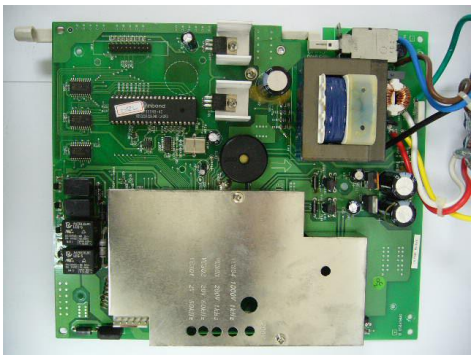
4. Slide the rear panel out carefully.



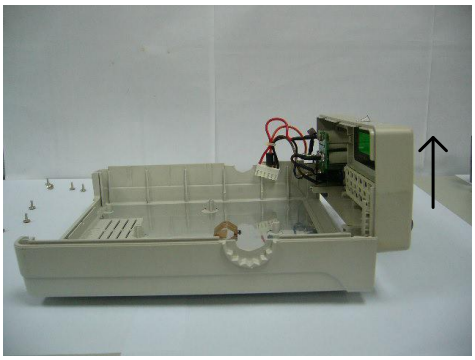
5. Remove the connections from the power socket and remove the rear panel grounding connection.



6. Slide the main PCB out from the bottom case.



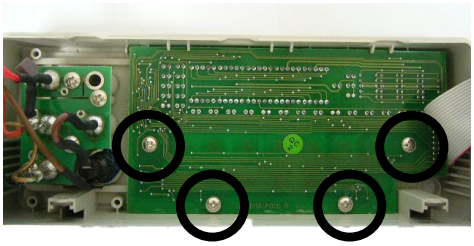
7. Slide the front panel PCB up to remove from the bottom case.



Removal of the main PCB and the front, rear and bottom panels is complete. Reverse the procedure to re-assemble.

Front Panel PCB Removal.

1. Remove the front panel from the bottom case and main PCB. Page 87
2. Remove the 4 screws from the front panel PCB.

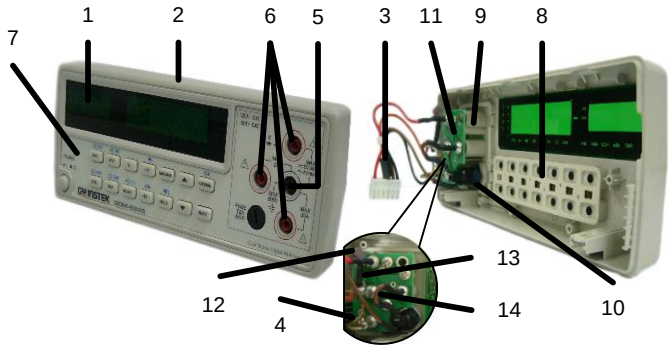


3. Remove the PCB to reveal the LEDs and key matrix.

Removal of the front panel PCB is complete.

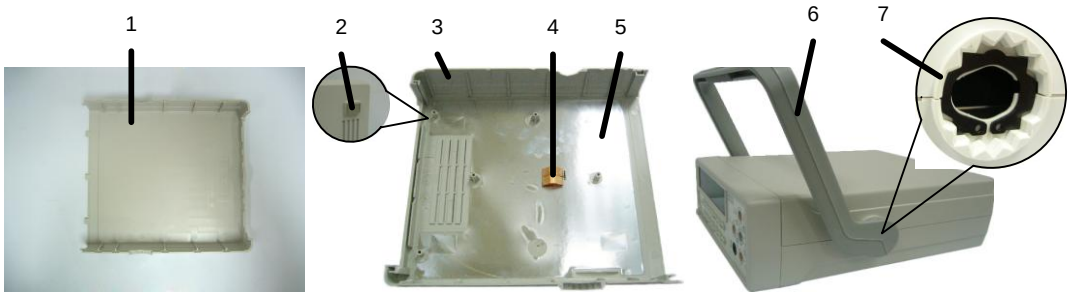
GDM-8245 Mechanical Parts List

Front Panel



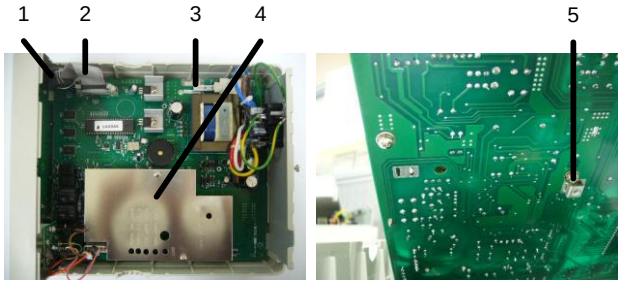
No.	Qty.	Description	Part number
1	1	NP GDM-8245 ACRYLIC ,RoHS	51DM-824502C1
2	1	PC GOM/GPM/GDM-8246 Plastic Front Frame,GRAY, RoHS	63PF-AG1027A1
3	1	CORE A5 RH 7.8*12.7*4.1	3065-001A040
11	1	PCB DM01P03B ,2 ,FR4 (8 IN ONE PCS)	35DM-01P030B
4	1	NICHROME WIRE 2@ ,85m/m (5W 0.01RF) ,RoHS	4260-20D08501
5	1	BINDING POST DM01M07A ,1P ,0 (Black terminal)	44BJ-011005A
6	3	BINDING POST DM01M07A ,1P ,2 (Red terminal)	44BJ-211004A
7	1	NP GDM-8245 MAIN NP (新 LOGO) ,RoHS	51DM-824501D1
8	1	SILICON RUBBER GDM-8245/8246 ,GRAY ,RoHS	57RB-40G036A1
9	1	PC GDM-8245/6 TERMINAL HOLDER PLATE,ABS,GRAY,RoH	63PH-AG1003B1
10	1	FUSE HOLDER R3-11 ,5*20m/m ,RoHS	37H1-52000301
12	1	CSG 2KV +/-500V ,SG5-202FPCB	22G1-2K00100
13	1	RC 2W ,10kJ ,SPR2CL20A ,RoHS	2005B10B3J031
14	1	LW 18,UL1015,1 1,50m/m,10 5,M ,RoHS	4217-21105081
1,2 7 (set)	1	GDM-8245 FRONT FRAME + ACRYLIC RoHS	1042-82450101
1,2,7	1	PCB ASS'Y DM01P020 ,GDM-8245	13DM-8245020

Top and Bottom Case



No.	Qty.	Description	Part number
1	1	PC TOP COVER ,GRAY	63UP-AG1062B
2	2	RUBBER FOOT TF-419NP(G) ,21.8*15.8*5.5 ,RoHS	57FC-40G001B1
3	1	PC SFG-1003/1013 BOTTOM COVER ,GRAY ,RoHS	63LO-AG102001
4	1	CA FRP-375P80-02T, RoHS	62DS-830PP101
5	1	AL PAPER FG02M190 ,207*196*0.1T	6861-2071960
6	1	PC HANDLE ,GRAY ,RoHS	63HD-AG1010B1
7	2	WASHER "C TYPE" ,20.8*29.7*1 ,T, RoHS	619H-208297T1

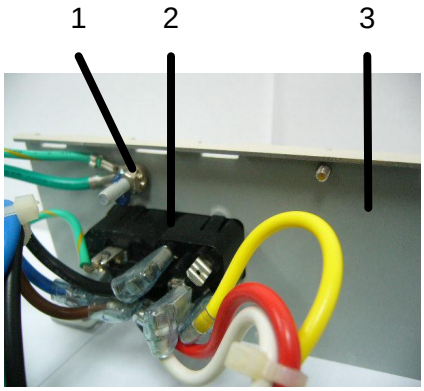
PCB Parts



Top Bottom

No.	Qty.	Description	Part number
1	2	CORE RECTANGLE A5 FP 38*6.35*10	3065-002A080
2	1	FLAT CABLE 20P ,100mm ,RoHS (Part ID J601) and plugs	40WC-D2001501
3	1	PC SW LINK ,ABS+PC ,GRAY ,RoHS	63LK-SG100101
4	1	CA DM01M06D ,EMI SHIELD COVER	62DM-245SP1D
5	1	CA JH-4-T ,SOLDER PLATE ,180D	62DM-245ST10

Rear Panel and Handle



No.	Qty.	Description	Part number
1	1	RT00-15#22-130mm-4/5-0 ,JFE-9511028-18 ,RoHS	40WCJ10100681
2	1	PS 42R343111200-H8 ,10A ,250V ,3P ,FH VS ,M,UL VDE	3610-0100053
3	1	CA DM01M01D ,REAR PALTE	62DM-245RP1D

Others

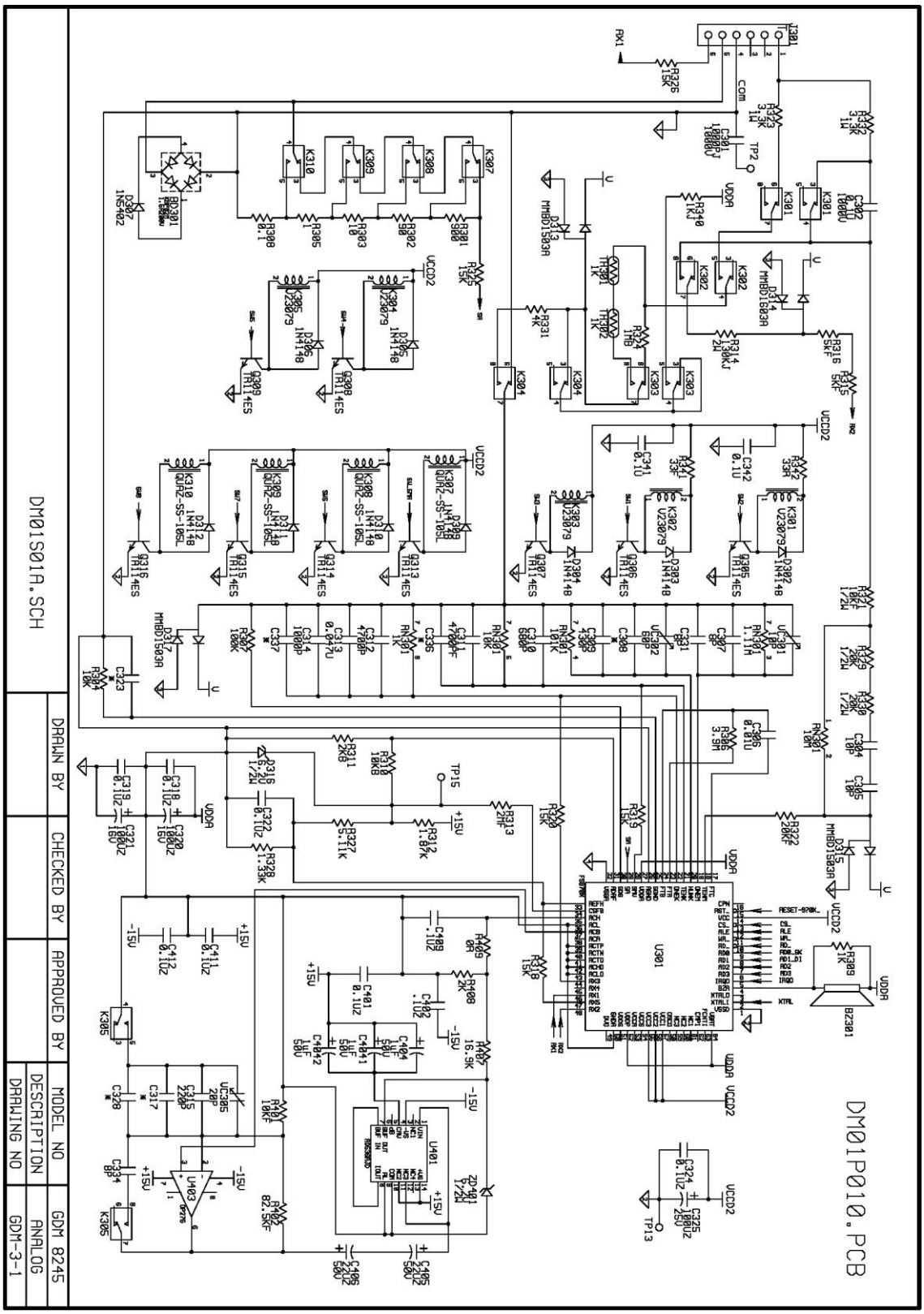
Part ID	Qty.	Description	Part number
AC115V fuse	1	FUSE T 5.0*20 0.1A 250V VDE/SEMKO S504/179120	37FT-1124101
AC230V fuse	1	FUSE T 5.0*20 0.08A 250V VDE/SEMKO S504/179120	37FT-1124800
Screw - plain	7	SCREW TRUSS ,+ ,3*6*0.5P ,B TYPE ,	591B-T3006NB
Ground connection bolt	1	SCREW PMS ,TORX ,4*10 ,ISO ,N	592J-04010NS
Screw with washer	11	SCREW BMS 3*6 ,ISO ,N (WASHER P ,S)	594B-W3006NS
Washer	2	CA FG02M15A ,SCREW HOLDER PLATE	62FG-215HP1A
Mainboard PCB (plain)	1	PCB DM01P01D ,2 ,FR4 ,GDM-8245	35DM-01P010D
Front panel PCB	1	PCB DM01P02D ,2 ,FR4 (2 IN ONE PCS) ,GDM-8245	35DM-01P020D
Test lead pair black and red	1	TL GTL-117 ,KETL8107TA ,RoHS	1100-TL117001
Power cable	1	L.C. 14 B+G ,PHS-301RL ,H05 3/0.75 ,6FT ,VDE ,RoHS	4343-40600101

CIRCUIT DIAGRAMS AND COMPONENT PARTS LIST

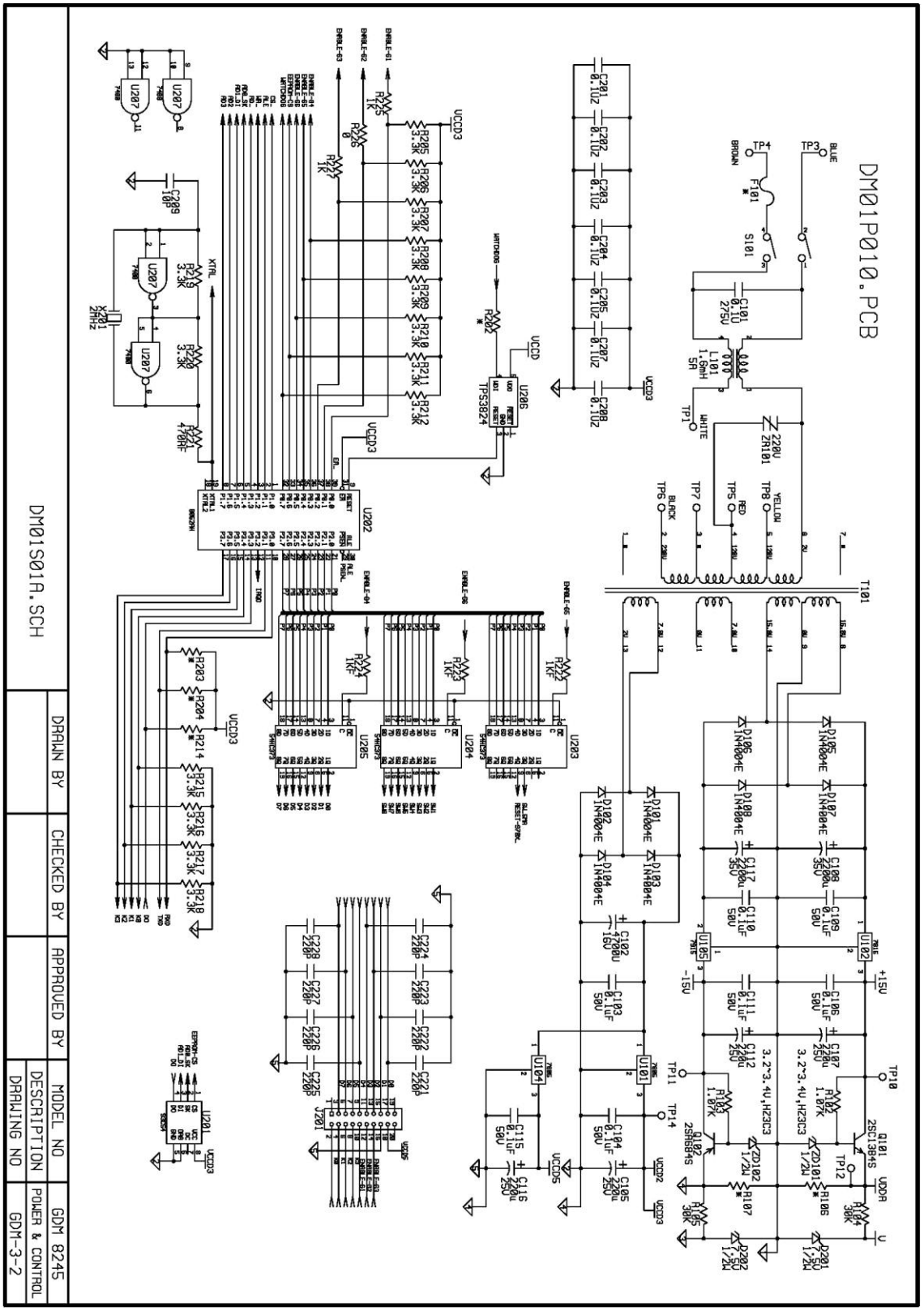
This chapter shows the operation theory of the instrument alongside the relevant circuit diagrams, which make tracking the problem source easy.

After problematic locations are discovered, the *Components Parts List* may be used for securing replacement parts.

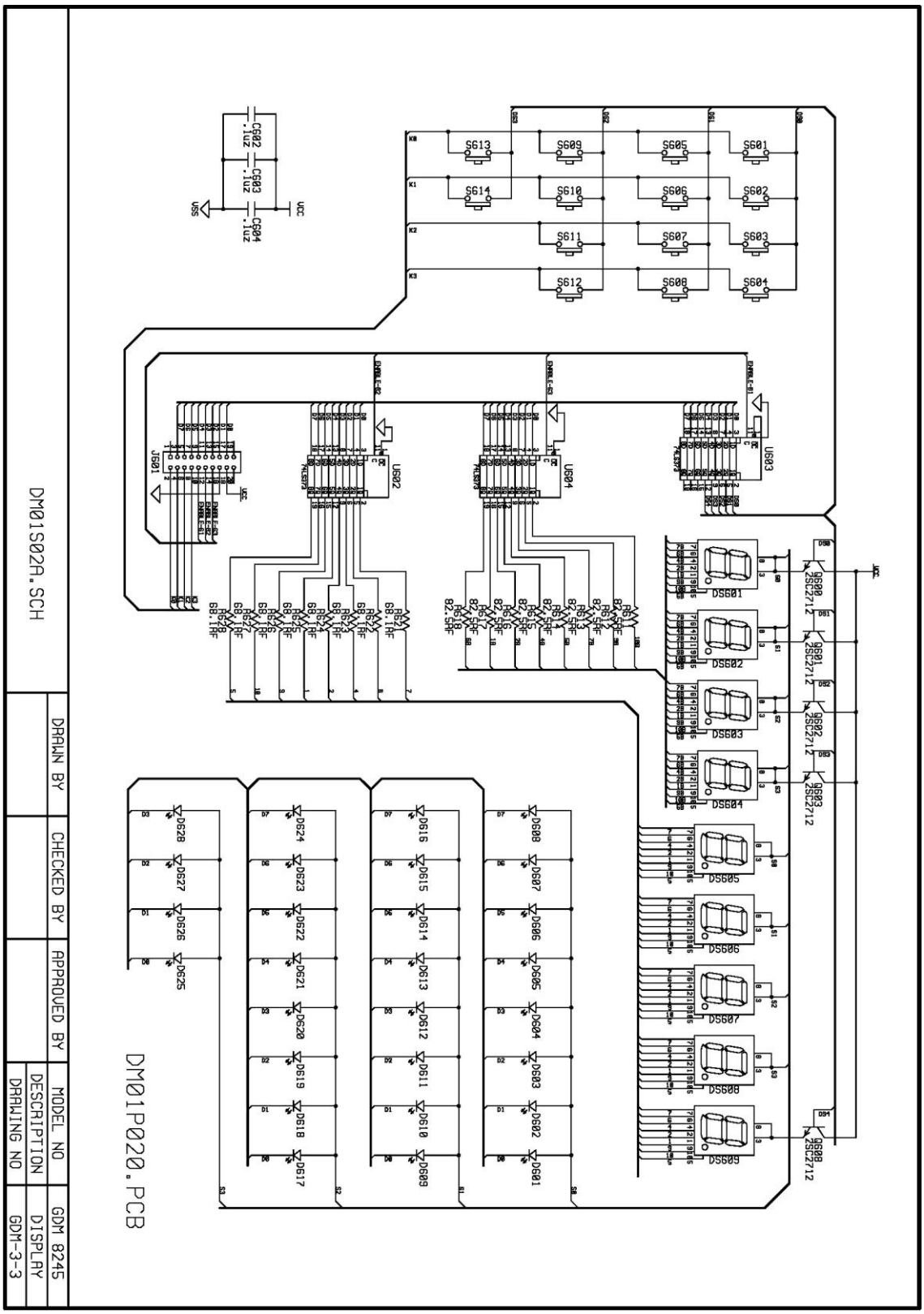
Circuit Diagram 1 (GDM-8245)



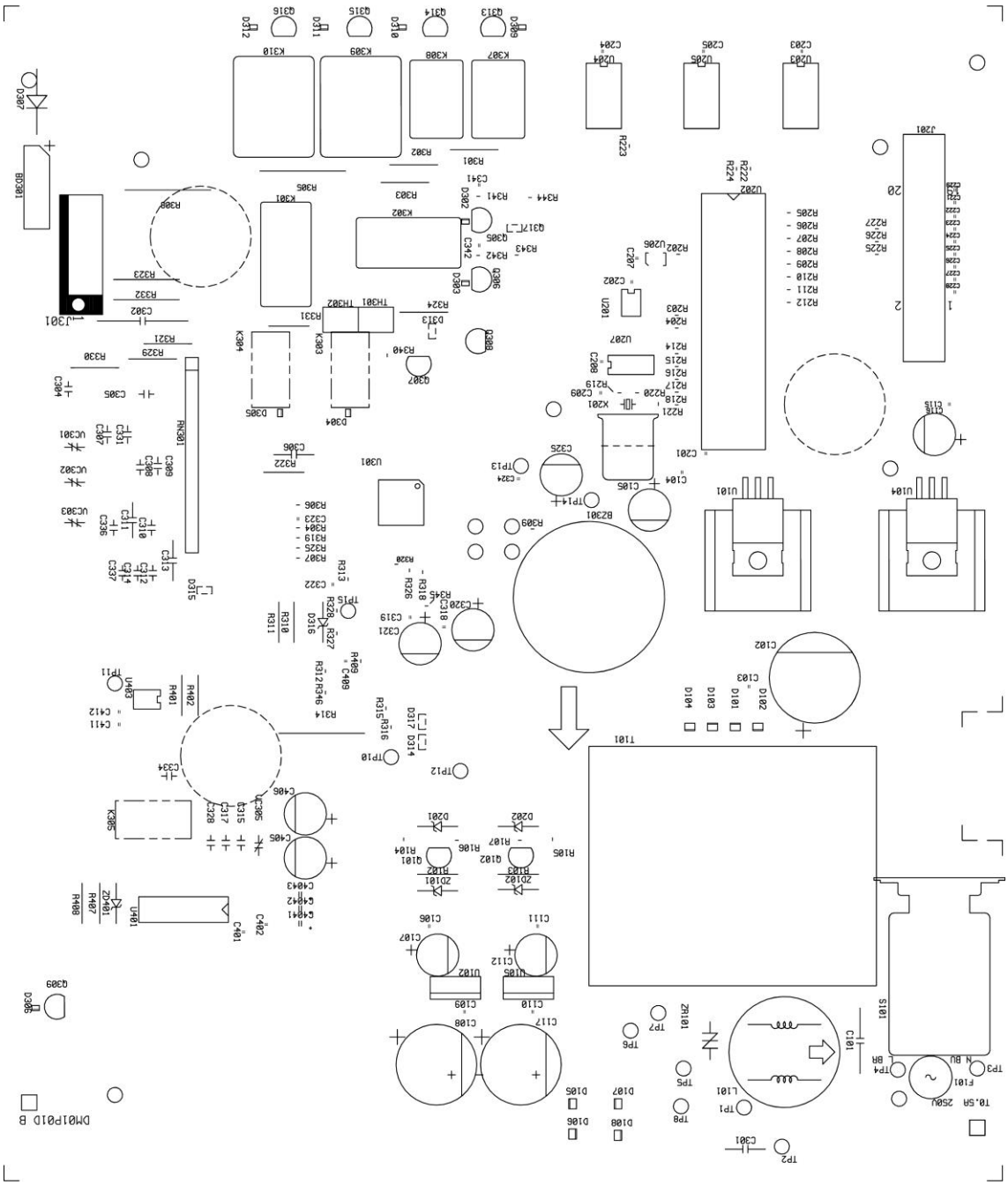
Circuit Diagram 2 (GDM-8245)



Circuit Diagram 3 (GDM-8245)



Circuit Layout (GDM-8245)



GDM-8245 Component Parts List

Part ID	No.	Description	Part number
F301,	1	FUSE T 5.0*20 2A 250V UL/CSA GMC-2A	37FT-1114202
AC230V,	1	FUSE T 5*20 0.08A 250V, 218XP, RoHS	37FT-11648001
J301,	1	VH00-32#22-100mm-2BB310-2, JFE-9512013-2, RoHS	40WCJ30600301
	2	PILLAR HEXAGON ,M3*20m/m ,N ,RoHS (nut)	66AN-20000001
R401,	1	RM 1/4W ,10kF ,T52 ,MF1/4W1% ,RoHS	2012-1002FH01
R408,	1	RM 1/4W ,2kF ,T52 ,MF1/4W1% ,RoHS	2012-2001FH01
R402,	1	RM 1/4W ,82.5kF ,T52 ,MF1/4W1% ,RoHS	2012-8252FH01
ZD101,ZD102,	2	ZENER 1/2W ,3.3V-3.5V ,HZ3C3 ,HITACHI ,HT ,T 52	2503H0330050
R102,R103,	2	RM 1/4W ,1.07kF ,T52 ,MF1/4W1% ,RoHS	2012-1071FH01
R226,R409,	2	R CHIP 1/10W ,0RJ ,RC0603 ,RoHS	20C0-0000J211
R222,R340,R309,R227,R225, R223,R224,	7	R CHIP 1/10W ,1kF ,RC0603 ,RoHS	20C0-1001F211
R304,	1	R CHIP 1/10W ,10kF ,RC0603 ,RoHS	20C0-1002F211
R307,	1	R CHIP 1/10W ,100kF ,RC0603 ,RoHS	20C0-1003F211
R328,R344,R343,	3	R CHIP 1/10W ,1.33kF ,RC0603 ,RoHS	20C0-1331F211
R326,R325,R320,R319,R318,	5	R CHIP 1/10W ,15kF ,RC0603 ,RoHS	20C0-1502F211
R104,R105,	2	R CHIP 1/10W ,30kF ,RC0603 ,RoHS	20C0-3002F211
R205,R215,R216,R217,R218, R219,R220,R209,R208,R207, R206,R212,R210,R211,	14	R CHIP 1/10W ,3.3kF ,RC0603 ,RoHS	20C0-3301F211
R341,R342,	2	R CHIP 1/10W ,33RF ,RC0603 ,RoHS	20C0-330DF211
R312,R346,	2	R CHIP 1/10W ,475RF ,RC0603 ,RoHS	20C0-4750F211
	3	R CHIP 1/10W ,5.11kF ,RC0603 ,RoHS	20C0-5111F211
C4041,	1	CST 25V ,1UM ,A CASE ,TMCMA1E105MTR	226A-25105M0
C209,	1	CSL 50V, 10pJ, NPO, U0603C100JCT, RoHS	22EJ-50100J01
C401,C342,C341,C324,C319, C318,C208,C409,C411,C412, C202,C111,C106,C115,C201, C207,C204,C110,C109,C402, C103,C104,C203,C205,	24	CSL 50V ,0.1uZ ,Y5V ,0603 ,RoHS	22EJ-50104Z01
C227,C228,C229,C225,C224, C223,C222,C221,C226,	9	CSL 50V, 220pJ, NPO, U0603C221JCT, RoHS	22EJ-50221J01
Q317,	1	TR 2SC2712-Y(or O)(F) (TE85R) SMD, TOSH, RoHS	2602-2712Y0T1
R313,	1	R CHIP 1/10W ,2MF ,RC0603 ,RoHS	20C0-2004F211
R345,	1	R CHIP 1/10W ,2.2RJ ,RC0603 ,RoHS	20C0-22BDJ211
R306,	1	R CHIP 1/10W ,3.9MF ,RC0603 ,RoHS	20C0-3904F211
R221,	1	R CHIP 1/10W ,470RF ,RC0603 ,RoHS	20C0-4700F211
C4042,C4043,	2	CST 35V 0.1uM ,A CASE ,SVHA1V104M ,NEC ,RoHS	226A-35104M01
D108,D102,D105,D103,D10 4,D107,D106,D101,	8	DIODE GL41G ,Vr=400V ,I=1A ,SMD	2501-GL41G20
D312,D302,D304,D305,D30 6,D309,D310,D303,D311,	9	DIODE RLS4148TE-11 ,SMD (LL34) ,ROHM ,RoHS	2502-N4148201
U207,	1	IC SN74HC00DR ,SMD ,TEXAS ,RoHS	271174HC00DR1
U203,U204,U205,	3	IC 74HC373D ,SMD ,PHILIPS ,RoHS	2729-74HC3731
U201,	1	IC AT93C56A-10SU-2.7, SMD, ATMTL, RoHS	2765-93C56001
D317,D313,D315,D314,	4	DIODE MMBD1503A, SOT-23, FAIRCHILD, RoHS	2500-1503A201

U206,	1	IC TPS3824-50DBVRG4 ,SMD ,TEXAS ,RoHS	2711-382450Z1
U403,	1	IC OP37GSZ ,SMD ,ANDE ,RoHS	2715-37GSZ001
K303,K304,K305,	3	RELAY AXICOM V23079-D1001-B301 ,DC5V ,2A ,SMD	3322-05020301
U301,	1	IC FS9704BLQFP64 ,SMD ,FORTUNE ,RoHS	2774-9704B011
C312,	1	CSC 50V ,3300PK ,VT	2204-50332K0
C334,	1	CSN 50V ,10pD ,VT ,CHU5100DH ,RoHS	2214-50100D01
C308,	1	CSN 50V ,15pJ ,6@ ,VT ,CHU5150JH ,RoHS	2214-50150J01
C315,	1	CSN 50V ,220pJ ,11@ ,VT ,CHU0221JH ,RoHS	2214-50221J01
Q315,Q316,Q314,Q306,Q307,Q308,Q309,Q313,Q305,	9	TR DTC 114ES ROHM ,VT	2615-114ES-V
C314,	1	CSC 50V ,1000pK ,VT ,BU4102KH ,RoHS	2204-50102K01
C310,	1	CSN 50V ,330pJ ,VT ,NPO ,CHU0331JH ,RoHS	2214-50331J01
C405,C406,	2	CSE1 50V 22uM VT 5@*11 F=5 SKP220M1HD11H RoHS	2244-50226M01
C320,C321,C325,	3	CSE1 16V 100uM VT 5@*11 F=5 SKP101M1CD11H RoHS	2244-16107M21
C105,C107,C112,C116,	4	CSE1 25V 220uM VT 8@*11 F=5 SKP221M1EF11H RoHS	2244-25227M01
R311,	1	RM 1/8W ,2KB ,RN55 ,10PPM	2011-2001B00
R310,	1	RM 1/8W ,10KB ,RN55 ,10PPM	2011S1002B10
R324,	1	RM 1/4W ,1MB ,RN60 ,25PPM	2012-1004B00
R303,	1	RM 1/4W ,10RB ,RN60E	2012-100DB00
R407,	1	RM 1/4W ,16.9kF, ,T52 ,MF1/4W1% ,RoHS	2012-1692FH01
R322,	1	RM 1/4W ,20kF ,T52 ,MF1/4W1% ,RoHS	2012-2002FH01
R331,	1	RM 1/4W ,4.02kF ,T52 ,MF1/4W1% ,RoHS	2012-4021FH01
R301,	1	RM 1/4W ,900RB RN60E 09000B	2012-9000B00
R302,	1	RM 1/4W ,90RB ,RN60E 9000B	2012-900DB00
C305,C304,	2	CSN 1KV,10PD,6@,NPO,HP60SJCH100D,(F.S TYPE 30mm)	2211-1K100D8
C313,	1	CSD 250V ,0.047UJ ,ONLY	2271-2B473J0
C301,	1	CSK 1KV ,1000PJ ,ONLY	2291-1K102J0
C311,	1	CSK 50V ,4700PF +/-1% ,ONLY	2291-50472F0
VC302,VC303,	2	SVC TZ03P600FR169 ,6@ ,9.8-60P BROWN	2311-6000010
D307,	1	DIODE 1N5402 ,FORMING 22C-410 ,G.I	2501-N54020J
ZD401,	1	ZENER 1/2W ,6.0-6.3V ,HZ6C2 ,HITACHI ,HT ,T52	2503H0620051
ZR101,	1	ZNR PVR14D221KB(ERZV14D221) ,220V ,14@ , RoHS	2506-22117001
Q102,	1	TR 2SA684R ,PANASONIC ,RoHS	2600-68400001
U101,U104,	2	IC UA7805UC ,FAIRCHILD(LM7805CT ,NS) (AN7805 MATS)	2701-7805UCZ
U401,	1	*IC AD536AJH ,ANDE (AD536AJD ,AD536AKH ,ANDE),RoHS	2715-536AJHZ1
X201,	1	CRYSTAL 4.000MHz HC-49/U (H49-4.0000-20)	2800-04M0007
L101,	1	COIL 1.6mH ,5A Q>=2.2 18T 0.75@ ,APS-10452 (CE)	2900-162502A
T101,	1	TS GDM-8245-PT ,PCB ,HP-057190697 100/120/230V	3000-DM01600
K308,K307,	2	RELAY OEG OUAZ-SS-105L ,DC5V ,40mA ,PCB ,SPDT	3312-05P0010
K301,K302,	2	RELAY DS2E-SNil-DC5V-R ,DC5V ,2A ,DPDT	3322-0502050
BZ301,	1	PIEZO BUZZER 2.5kHz 30m/m	3811-0300020

J301,	1	WAFER B6P-VH	40WA-B6PVH00
X201,	1	JUMP WIRE 0.6@ ,HT ,160(OD)*22(ID)*115(H)/ROLL	4270-06D0000
D201,D202,	2	ZNR P6KE8.2CA ,8.2V ,600W	2506-0800710
J201,	1	LATCH EJECTOR ,20P ,3428-6302 3M	40LE-020H01H
D316,	1	ZENER ,1N827 ,T52 DO-34 ,PHILIPS(94-06-30)	2503H0620021
C306,	1	CSD 100V ,0.01UJDC ,MPE ,RoHS	2271-1A103J01
TP3,	1	FO00-17#18-130mm-6-0 ,JFE-9511028-10 ,RoHS	40WCJ10103771
TP4,	1	FO00-17#18-130mm-1-0 ,JFE-9511028-9, RoHS	40WCJ10103781
TP6,	1	FO00-17#18-130mm-0-0 ,JFE-9511028-7 ,RoHS	40WCJ10103811
TP5,	1	FO00-17#18-130mm-2-0 ,JFE-9511028-6 ,RoHS	40WCJ10103821
TP8,	1	FO00-17#18-130mm-4-0 ,JFE-9511028-5 ,RoHS	40WCJ10103831
TP1,	1	FO00-17#18-130mm-9-0 ,JFE-9511028-8 ,RoHS	40WCJ10103801
TP2,	1	RT00-15#18-130mm-5-0, RoHS	40WCJ10103791
TH301,TH302,	2	THR PTC PDBB2102MS-5, 1k +/-20%, UEI, RoHS	2505-11020041
U202,	1	IC SOCKET 40P, R, A ,D=15.24, 1037011402, ACMULEX	3612-40R000A1
K309,K310,	2	RELAY TRD-5VDC-FB-CL ,5V ,12A	3312-0512010
R329,	1	RM 1/2W ,21.5kF ,MF1/2DCT52A ,RoHS	2013-2152FH21
R330,	1	RM 1/2W ,32.4kF ,MF1/2DCT52A ,RoHS	2013-3242FH21
R314,	1	RM 2W ,130kF ,+/-50ppm ,M-TYPE P=20 ,MF-200 ,RoHS	2015C1303F031
R323,R332,	2	RM 1W ,3.3kF ,+/-50ppm ,M-TYPE P=15 ,MF-100 ,RoHS	2014C3301F021
R305,	1	RW 1W 0.9RB HOR 10PPM ,RoHS	2024S900MB101
R308,	1	NICHROME WIRE 1@ ,180m/m (2W 0.1RJ) ,RoHS	4260-10D18001
C101,	1	CSK AC275V ,0.1UM ,X2 ,MPX-104K27L15LL ,RoHS	2291-2Y104M01
S101,	1	SW PUSH KDC-A11-200-S ,DPDT ,4P*1 PP ,RoHS	3202-11214101
Q101,	1	TR 2SC 1384R ,PANASONIC ,RoHS	2602-13840001
C309,	1	CSI 100V ,430PJ ,CD15FD431J03F ,RoHS	22C1-1A431J01
C307,C331,	2	CSI 500V ,8PD ,CD15CD080D03F ,RoHS	22C1-5A080D01
F101,	1	FUSE T 8.35*7.7 0.5A 250V U/C/V/S MRT-0.5 ,bel	37FT-77945011
U202,	1	*IC W78E054C-40DL ,GDM-8245 V2.00 (1AD065) W/LB	2799-04600601
RN301,	1	RN 10M+/-0.25%,15P(2-7,9,11 X)(SORTING,GDM-8245)	2062-SORT010
R321,	1	RM 1/2WS ,10kF ,T52 ,MF1/2WS1% ,RoHS	2013-1002FH01
U102,	1	IC AN7815 ,PANASONIC ,RoHS	2762-78150001
U105,	1	IC AN7915T ,PANASONIC ,RoHS	2762-7915T001
BD301,	1	BRIDGE KBP02G ,1.5A ,200V ,HY ,RoHS	2504-BP02G001
C302,	1	CTF 1500VDC ,0.033uK ,±10% ,MPA TYPE ,AID ,RoHS	2282-1L333K01
VC305,	1	SVC TZ03R200F169 ,6@ ,4.2-20P ,RED, RoHS	2311-20000301
VC301,	1	SVC TZ03Z100F169 ,6@ ,2.7-10P ,BLUE, RoHS	2311-10000501
C102,	1	CSE1 16V 4700uM 16@*25 F=7.5 SKR472M1CK25H RoHS	2241-16478M01

C108,C117,	2	CSE1 35V 2200uM 16@*25 F=7.5 SKR222M1VK25H RoHS	2241-35228M11
C604,C602,C603,	3	CSL 50V ,0.1uZ ,Y5V ,0603 ,RoHS	22EJ-50104Z01
R625,R621,R622,R624,R627, R628,R623,R626,	8	R CHIP 1/10W ,68.1RF ,RC0603 ,RoHS	20C0-681DF211
R611,R612,R613,R614,R615, R616,R617,R618,	8	R CHIP 1/10W ,82.5RF ,RC0603 ,RoHS	20C0-825DF211
D631,D632,D629,D630,	4	DIODE RLS4148TE-11 ,SMD (LL34) ,ROHM ,RoHS	2502-N4148201
Q602,Q608,Q603,Q600,Q60 1,	5	TR 2SC2712-Y(or O)(F) (TE85R) SMD, TOSH, RoHS	2602-2712Y0T1
U604,U603,U602,	3	IC 74HC373D ,SMD ,PHILIPS ,RoHS	2729-74HC3731
	23	LED GREEN, AL-R213P, 6.3*3.7*6.8m/m, IKATECH, RoHS	3111-15D10301
DS601,DS602,DS603,DS604,	4	DISPLAY GREEN LA3921-11-HE-EWAK ,0.39" ,RoHS	3131-12520101
DS605,DS606,DS607,DS608, DS609,	5	DISPLAY GREEN LA5021-11-HEEWRN035 ,0.5" ,RoHS	3131-12550201
J601,	1	FLAT CABLE 20P ,100mm ,RoHS	40WC-D2001501