

Chapter 6 Characteristics

General Technical Characteristics

Power Supply:

AC 100V~120V, 45Hz~440Hz

AC 200V~240V, 45Hz~66Hz

Power consumption: 20VA peak value

Mechanical:

Height × Width × Depth: 107.0mm×231.6mm ×290.5mm

Weight: 2.5kg

Display:

256×64 LCD display, support dual display, menu, Chinese and English languages, operation help.

Working Environment:

Precision 0~50°C, 80% R.H. at 40°C, No coagulation

Storage Temperature: -20~70°C

Impact and Shake: According with MIL-T-28800E, III class, 5 Level (Only Sine)

Height above sea level: upper limit 3000m

Safety:

According with IEC61010-1: 2001.

Measure CAT I 1000V, CAT II 600V.

Class of pollution: 2.

Remote Interface:

GPIB (only for DM3058), 10/100Mbit LAN (only for DM3058), USB2.0 Full Speed Device & Host (support USB flash device), RS232.

Programming Language:

RIGOL DM3058 SCPI, Fluke 45, Agilent 34401A.

LXI Compatibility: LXI Class C, Version 1.1 (only for DM3058).

Warm-up Time: 30min.

Electric Technique Characteristics

DC Characteristics

Accuracy Specifications (% of reading + % of range)^[1]

| Function | Range ^[2] | Test Current or Burden Voltage | 1 Year 23°C±5°C | Temperature Coefficient 0 °C to 18 °C 28 °C to 55 °C |
|---------------------------------|-------------------------|--------------------------------|--------------------|------------------------------------------------------------|
| DC Voltage | 200.000mV | | 0.015 + 0.004 | 0.0015+0.0005 |
| | 2.00000V | | 0.015 + 0.003 | 0.0010+0.0005 |
| | 20.0000V | | 0.015 + 0.004 | 0.0020+0.0005 |
| | 200.000V | | 0.015 + 0.003 | 0.0015+0.0005 |
| | 1000.00V ^[4] | | 0.015 + 0.003 | 0.0015+0.0005 |
| DC Current | 200.000µA | <8mV | 0.055 + 0.005 | 0.003+0.001 |
| | 2.00000mA | <80mV | 0.055 + 0.005 | 0.002+0.001 |
| | 20.0000mA | <0.05V | 0.095 + 0.020 | 0.008+0.001 |
| | 200.000mA | <0.5V | 0.070 + 0.008 | 0.005+0.001 |
| | 2.00000A | <0.1V | 0.170 + 0.020 | 0.013+0.001 |
| | 10.0000A ^[5] | <0.3V | 0.250 + 0.010 | 0.008+0.001 |
| Resistance^[3] | 200.000Ω | 1mA | 0.030 + 0.005 | 0.0030+0.0006 |
| | 2.00000kΩ | 1mA | 0.020 + 0.003 | 0.0030+0.0005 |
| | 20.0000kΩ | 100µA | 0.020 + 0.003 | 0.0030+0.0005 |
| | 200.000kΩ | 10µA | 0.020 + 0.003 | 0.0030+0.0005 |
| | 2.00000MΩ | 1µA | 0.040 + 0.004 | 0.0040+0.0005 |
| | 10.0000MΩ | 200nA | 0.250 + 0.003 | 0.0100+0.0005 |
| 100.000MΩ | 200nA 10MΩ | 1.75 + 0.004 | 0.2000+0.0005 | |
| Diode Test | 2.0000V ^[6] | 1mA | 0.05 + 0.01 | 0.0050+0.0005 |
| Continuity | 2000Ω | 1mA | 0.05 + 0.01 | 0.0050+0.0005 |

- [1] Specifications are for 30 minute warm-up, "slow" measurement rate and 18 °C ~ 28 °C calibration temperature.
- [2] 20% over range on all ranges, except DCV 1000V, ACV 750V, DCI and ACI 10A range.
- [3] Specifications are for 4-wire resistance function, or 2-wire resistance using REL operation. Without REL operation, add 0.2 Ω additional errors in 2-wire resistance function.
- [4] For each additional 1 volt over ± 500 VDC add 0.02 mV of error.
- [5] For current terminal, > 7A DC or AC RMS for 30 seconds ON and 30 seconds OFF.
- [6] Accuracy specifications are for the voltage measured at the input terminals only. 1 mA test current is typical. Variation in the current source will create some variation in the voltage drop across a diode junction.

DC Voltage

| | | |
|-------------------------------------|-----------------------------------------------------------------------------------------------------------------|------------------------------------------|
| Input Resistance: | 200mV and 2V range | 10M Ω or >10G Ω selectable |
| | (Input signals which exceed $\pm 2.5V$ in these ranges will pass the 100k Ω (typical) clamp resistance.) | |
| | 20V, 200V and 1000V range | 10M Ω \pm 2% |
| Input offset current: | <90pA, 25 $^{\circ}$ C | |
| Input Protection: | 1000V on all ranges | |
| CMRR (common mode rejection ratio): | 120dB (For the 1k Ω unbalanced resistance in LO lead, maximum $\pm 500VDC$). | |
| NMRR (normal mode rejection ratio): | 60dB at "slow" measurement rate | |
| | Add 20dB when open the "AC filter" (Settling time adds 0.35s (source impedance near zero)) | |

Resistance

| | |
|-----------------------|--------------------------------------------------------------------------------------------------|
| Measurement Method: | Selectable 4-wire or 2-wire. |
| | Current source referenced to LO input. |
| Open-circuit Voltage: | Limit in <8V. |
| Max. Lead Resistance: | 10% of range per lead for 200 Ω , 1k Ω per lead (4-wire ohms) on all other ranges. |
| Input Protection: | 1000V on all ranges. |

DC Current

| | |
|-------------------|------------------------------------------------|
| Shunt Resistor: | 200 μ A sampling voltage<8mV |
| | 2mA sampling voltage<80mV |
| | 1 Ω for 20mA, 200mA |
| | 0.01 Ω for 2A, 10A |
| Input Protection: | Externally accessible 10A, 250V fast-melt fuse |
| | Internal 12A, 250V slow-melt fuse |

Continuity / Diode Test

| | |
|-----------------------|-------------------------------------------------------|
| Measurement Method: | 1mA \pm 5% current source, <8V open-circuit voltage |
| Response Time: | 123 samples / sec, with beeper |
| Continuity Threshold: | Adjustable from 1 Ω to 2000 Ω |
| Input Protection: | 1000V |

Setting time attentions:

Settling time in voltage measurement is affected by the source impedance, media characteristics of the cable and input signals.

AC Characteristics

Accuracy Specifications (% of reading + % of range)^[1]

| Function | Range ^[2] | Frequency Range | 1 Year 23°C±5°C | Temperature Coefficient 0 °C to 18 °C 28 °C to 55 °C |
|------------------------------------|-------------------------|-----------------|--------------------|------------------------------------------------------------|
| True RMS AC Voltage ^[3] | 200.000mV | 20Hz - 45Hz | 1.5 + 0.10 | 0.01+0.005 |
| | | 45Hz - 20kHz | 0.2 + 0.05 | 0.01+0.005 |
| | | 20kHz - 50kHz | 1.0 + 0.05 | 0.01+0.005 |
| | | 50kHz - 100kHz | 3.0 + 0.05 | 0.05+0.010 |
| | 2.00000V | 20Hz - 45Hz | 1.5 + 0.10 | 0.01+0.005 |
| | | 45Hz - 20kHz | 0.2 + 0.05 | 0.01+0.005 |
| | | 20kHz - 50kHz | 1.0 + 0.05 | 0.01+0.005 |
| | | 50kHz - 100kHz | 3.0 + 0.05 | 0.05+0.010 |
| | 20.0000V | 20Hz - 45Hz | 1.5 + 0.10 | 0.01+0.005 |
| | | 45Hz - 20kHz | 0.2 + 0.05 | 0.01+0.005 |
| | | 20kHz - 50kHz | 1.0 + 0.05 | 0.01+0.005 |
| | | 50kHz - 100kHz | 3.0 + 0.05 | 0.05+0.010 |
| | 200.000V | 20Hz - 45Hz | 1.5 + 0.10 | 0.01+0.005 |
| | | 45Hz - 20kHz | 0.2 + 0.05 | 0.01+0.005 |
| | | 20kHz - 50kHz | 1.0 + 0.05 | 0.01+0.005 |
| | | 50kHz - 100kHz | 3.0 + 0.05 | 0.05+0.010 |
| 750.000V | 20Hz - 45Hz | 1.5 + 0.10 | 0.01+0.005 | |
| | 45Hz - 20kHz | 0.2 + 0.05 | 0.01+0.005 | |
| | 20kHz - 50kHz | 1.0 + 0.05 | 0.01+0.005 | |
| | 50kHz - 100kHz | 3.0 + 0.05 | 0.05+0.010 | |
| True RMS AC Current ^[4] | 20.0000mA | 20Hz-45Hz | 1.5 + 0.10 | 0.015+0.015 |
| | | 45Hz-2kHz | 0.50 + 0.10 | 0.015+0.006 |
| | | 2kHz-10kHz | 2.50 + 0.20 | 0.015+0.006 |
| | 200.000mA | 20Hz-45Hz | 1.50 + 0.10 | 0.015+0.005 |
| | | 45Hz-2kHz | 0.30 + 0.10 | 0.015+0.005 |
| | | 2kHz-10kHz | 2.50 + 0.20 | 0.015+0.005 |
| | 2.00000A | 20Hz-45Hz | 1.50 + 0.20 | 0.015+0.005 |
| | | 45Hz-2kHz | 0.50 + 0.20 | 0.015+0.005 |
| | | 2kHz-10kHz | 2.50 + 0.20 | 0.015+0.005 |
| | 10.0000A ^[5] | 20Hz-45Hz | 1.50 + 0.15 | 0.015+0.005 |
| | | 45Hz-2kHz | 0.50 + 0.15 | 0.015+0.005 |
| | | 2kHz-5kHz | 2.50 + 0.20 | 0.015+0.005 |

| Additional wave crest factor error (not Sine) ^[6] | |
|--------------------------------------------------------------|-----------------|
| Wave crest coefficient | Error (% range) |
| 1 - 2 | 0.05 |
| 2 - 3 | 0.2 |

- [1] Specifications are for 30 minute warm-up, "slow" measurement rate and 18°C - 28°C calibration temperature.
- [2] 20% over range on all ranges, except DCV 1000V, ACV 750V, DCI and ACI 10A range.
- [3] Specifications are for sine wave input >5% of range. 750V range is limited to 8×10^7 Volt-Hz. For inputs from 1% to 5% of range and <50 kHz, add 0.1% of range additional error. For 50 kHz to 100 kHz, add 0.13% of range.
- [4] Specifications are for sine wave input >5% of range. Add 0.1% of the range for the sine wave input is 1%–5% of the range.
- [5] For continuous current which is higher than DC 7A or AC RMS 7A, disconnecting for 30s after 30s connection.
- [6] For frequency <100 kHz. Please refer to the "*Crest Factor Errors (non-sinusoidal inputs)*" section described on Page 5-3 for bandwidth error of other frequency.

True RMS AC Voltage

| | |
|-------------------------------------|------------------------------------------------------------------------------------------------------------|
| Measurement Method: | AC coupled true-RMS-measure, the DC component of input with up to 1000V on any range. |
| Crest factor: | Crest factor on full range ≤ 3 |
| Input Impedance: | $1\text{M}\Omega \pm 2\%$ in parallel with 100pF on any ranges |
| Input Protection: | 750Vrms on all ranges |
| AC filter bandwidth: | 20Hz~100kHz |
| CMRR (common mode rejection ratio): | 60dB (For the $1\text{k}\Omega$ unbalanced resistance in LO lead and <60Hz, maximum $\pm 500\text{VDC}$). |

True RMS AC Current

| | |
|---------------------|----------------------------------------------------------------------------------------------------|
| Measurement Method: | DC coupled to the fuse and shunt. AC coupled true RMS measurement (measures the ac component only) |
| Crest factor: | Crest factor on full range ≤ 3 |
| Max. Input: | The DC + AC current peak value <300% of the range. The RMS current including DC current is <10A. |
| Shunt Resistor: | 0.01Ω for 2A, 10A 1Ω for 20mA, 200mA |
| Input Protection: | Externally accessible 10A, 250V fast-melt fuse Internal 12A, 250V slow-melt fuse |

Setting time attentions:

Make sure the RC circuit of input terminal has been completely stable (up to 1s) before accurate measurement.

Input >300Vrms (or >5Arms) will cause the self heating of the signal conditioning component to

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generate error, this error is included in the characteristics of the instrument. Internal temperature variation results from the self heating will cause additional error on ac range, this error is lower than 0.02% reading, and it will disappear after a few minutes.

Frequency/Period Characteristics

Accuracy Specifications (% of reading + % of range)^[1]

| Function | Range | Frequency Range | 1 Year 23°C±5°C | Temperature Coefficient 0 °C to 18 °C 28 °C to 55 °C |
|---------------------|---------------------------------|-----------------|--------------------|------------------------------------------------------------|
| Frequency Period | 200mV to 750V ^[2] | 20Hz-2kHz | 0.01+0.003 | 0.002+0.001 |
| | | 2kHz-20kHz | 0.01+0.003 | 0.002+0.001 |
| | | 20kHz-200kHz | 0.01+0.003 | 0.002+0.001 |
| | | 200kHz-1MHz | 0.01+0.006 | 0.002+0.002 |
| | 20mA to 10A ^[3] | 20Hz-2kHz | 0.01+0.003 | 0.002+0.001 |
| | | 2kHz-10kHz | 0.01+0.003 | 0.002+0.001 |

[1] Specifications are for 30 minute warm-up.

[2] Unless otherwise noted, for frequency ≤100 kHz, the specifications are for AC input voltage of 15% to 120% of range. For frequency >100 kHz, the specifications are for AC input voltage of 40% to 120% of range. 750 V range is limited to 750Vrms. 200 mV range is full range input or input that is larger than the full range. For 30 mV to 200 mV inputs, multiply % of reading error by 10.

[3] Unless otherwise noted, the specifications are for AC input current from 15% to 120% of range except where noted. 20mA range specifications are for full scale. For inputs from 5mA to 20mA, multiply total % of reading error by 10. 10A range is for AC input current from 25% to 100% of range.

Measurement Characteristics

Frequency and Period

Measurement Method: Reciprocal-counting technique. AC-coupled input using the ac voltage or ac current measurement function.

Measurement attentions:

All frequency counters are susceptible to error when measuring low-voltage, low-frequency signals. Shielding inputs from external noise pickup is critical for minimizing measurement errors.

Setting time attentions:

Errors will occur when attempting to measure the frequency or period of an input following a dc offset voltage change. The input blocking RC time constant must be allowed to fully settle (up to 1 sec) before the most accurate measurements are possible.

Capacitance Characteristics

Accuracy Specifications (% of reading + % of range)^[1,2]

| Function | Range ^[2] | Test Current | 1 Year 23°C±5°C | Temperature Coefficient 0 °C to 18 °C 28 °C to 55 °C |
|-------------|----------------------|--------------|--------------------|---------------------------------------------------------------|
| Capacitance | 2.000nF | 200nA | 3 + 1.0 | 0.08+0.002 |
| | 20.00nF | 200nA | 1 + 0.5 | 0.02+0.001 |
| | 200.0nF | 2µA | 1 + 0.5 | 0.02+0.001 |
| | 2.000µF | 10µA | 1 + 0.5 | 0.02+0.001 |
| | 200µF | 100µA | 1 + 0.5 | 0.02+0.001 |
| | 10000µF | 1mA | 2 + 0.5 | 0.02+0.001 |

NOTE:

- [1] Specifications are for 30 minute warm-up using REL operation. Additional errors may occur for non-film capacitors.
- [2] Specifications are for 1% to 110% of range on 2 nF range and 10% to 110% of range on all other ranges.

Measurement Characteristics

Capacitance

Measurement Method: Current input with measurement of resulting ramp.

Connection Type: 2-wire

Input Protection: 1000V on all ranges

Measurement attentions:

Measurement of small capacitance is easily affected by external noise thus to cause measurement error, disable input will reduce this error.

Other Measurement Characteristics

Triggering and Memory

| | |
|-------------------------|----------------------------------------------------------|
| Samples per Trigger: | 1 to 2,000 |
| Trigger Delay: | 8ms to 2000ms |
| External trigger input: | |
| Input Level: | TTL compatible (High level when left trigger input open) |
| Trigger Condition: | Selectable Rising/Falling edges. |
| Input Impedence: | >20k Ω , in parallel with 400pF, DC-coupled |
| Min Pulse Width: | 500 μ s |
| VMC Output: | |
| Electric Level: | TTL compensate (Input \geq 1k Ω load) |
| Output polarity: | positive, negative(selectable) |
| Output impedance: | 200 Ω , typical |

Arbitrary sensor measurement

Support thermocouple, DC voltage, DC current, resistance (2-wire or 4-wire), capacitance and frequency output type sensors. Build in thermocouple cold side compensate.

Cold junction compensation: $\pm 3^{\circ}\text{C}$.

Preset ITS-90 transform of B, E, J, K, N, R, S and T thermocouple and transform of platinum Pt100, Pt385 resistance t temperature sensor.

Math function

Pass/Fail, RELative, Maximum/Minimum/Average, dBm, dB, Hold, Histogram, standard deviation.

History function

Volatile Memory: 2000 reading history record.

Nonvolatile Memory:

10 groups history data storage (2000 readings/group)

10 groups sensor data storage (1000 readings/group)

10 groups instrument settings storage

10 groups sensor settings storage

Support USB flash device external storage extend