DATA SHEET

Keysight U3606B
Multimeter I DC Power Supply

Convenient and Full Featured.
One-box source-and-measure device.

Introduction

Features

- Combination of a 5.5 digit digital multimeter and 30-W power supply in a single unit
- 10 DMM measurements, including 4-wire miliohm measurement
- 8 built-in math functions
- OVP and OCP for load protection
- Ramp and scan function, and built in square-wave output
- USB 2.0 interface and GPIB connectivity
- Kensington lock slot for security

Convenient two instruments in one box

Looking for a one-box source-and-measure device to meet your measurement needs? The Keysight Technologies U3606B Multimeter | DC Power supply is a full-featured 5.5 digit digital multimeter (DMM) that comes with a built-in 30-W power supply offering a compact footprint enabling you to get work done faster and easier. Being capable of powering up the DUT while measures Voltage and Current simultaneously, it enables users to perform two test functions within the same unit.

The U3606B is carefully thought out for your convenience and ease when operating. The convenient two-instruments-in-a-box concept is space and cost efficient, as less space is needed to accommodate one device instead of two. Also, the U3606B is lightweight enabling easy portability — lighter than both DMM and power supply combined, making it ideal for various industry such as education, commercial electronics, semiconductors, sensors and research and development.

KEYSIGHT TECHNOLOGIES

Sweep function (Ramp and scan)

Ramp and scan functions are mainly used to simplify device characterization for multilevel DC bias testing such as DC motor testing, transistor gain test, relay control and margin tests. Users have the choice to either manually perform quick verification testing through front panel or control operations remotely using simplified programming codes. Both functions are conveniently configurable via front panel to sweep up to 100 steps for scan and 10,000 steps for ramp, programmable up to 105% full scale.

Added Safety Features – With OVP, OCP and Physical lock security

Safety features in test instruments are always an added advantage. It does not only protect users from exposure to current, but also the additional costs incurred to their investment (DUT). Our U3606B is integrated with an array of security features such as over-voltage (OVP) and over-current (OCP) protection to mitigate these risks. Additionally, security feature such as Kensington lock slot strategically located at the rear of the unit secures your instrument from the risk of theft or misplacement when left unattended.

Square wave output

Square wave output is a unique function for many applications such as pulse-with modulation (PWM) output, adjustable voltage control, and synchronous clock. Users are able to check and calibrate flow-meter displays, tachometers, LED, sensors, oscilloscopes, frequency converters, frequency transmitters and other frequency input devices. The U3606B’s square wave output provides selectable frequencies up to 4.8 kHz with variable duty cycles and amplitudes.

More flexibility, more accuracy

Multiple connectivity options such as GPIB port and USB 2.0 provides more flexibility and robust connection between PC and U3606B Multimeter | DC Power supply. Users are able to connect the device directly to the PC host and work seamlessly with the Keysight Connectivity software or controlled remotely via standard SCPI commands. With two instruments in a single test box, less cable is required for troubleshooting providing better maintenance and wire management — essential for rack mount usage. U3606B also comes with 4-wire milliohm resistance measurement providing more accurate readings for device characterization as compared to the conventional 2-wire resistance measurement.

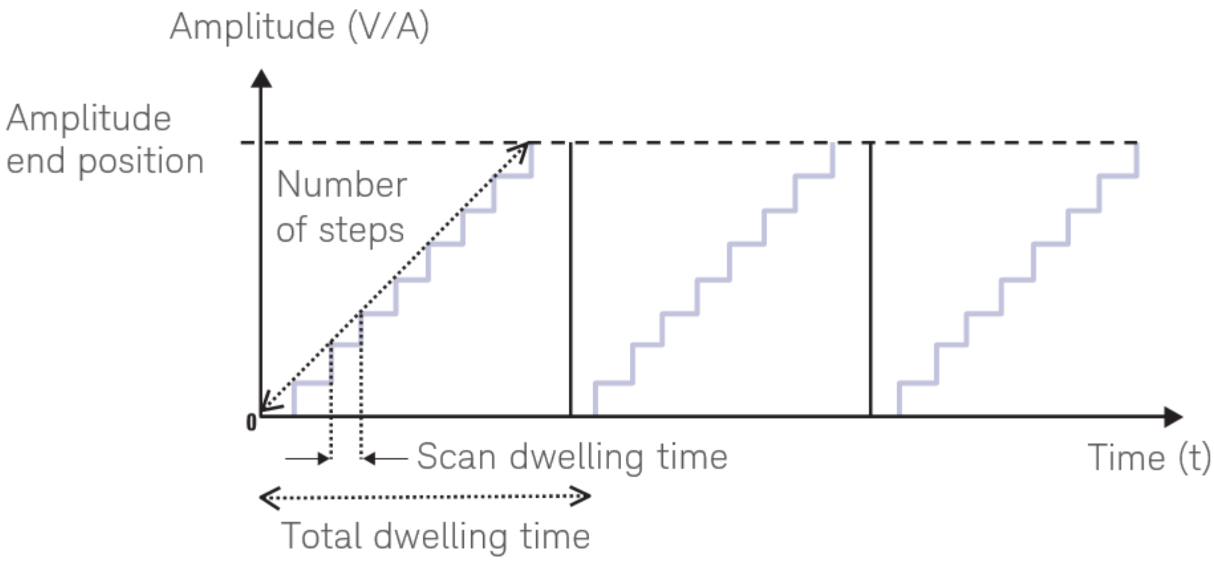

Figure 1. Scan Signal

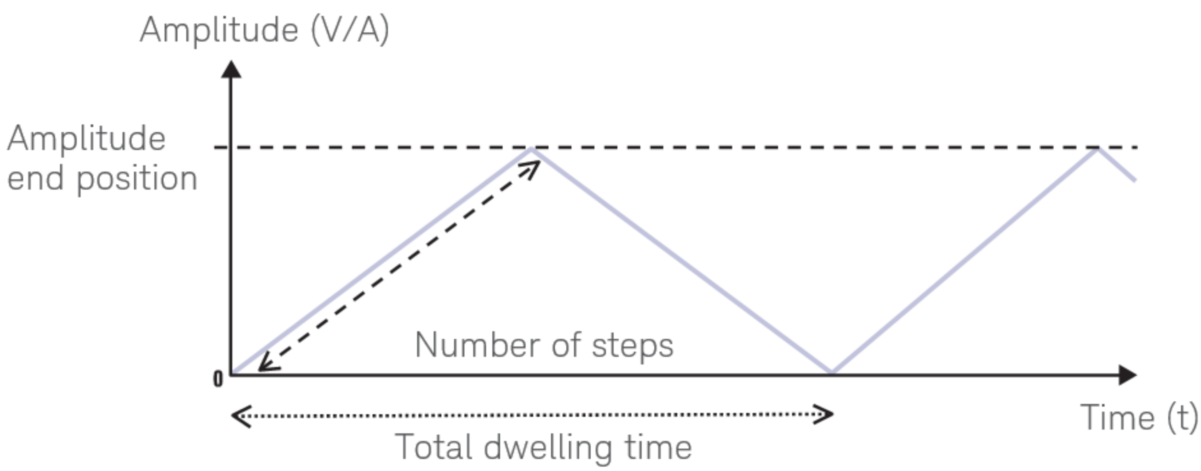

Figure 2. Ramp signal

Take a Closer Look

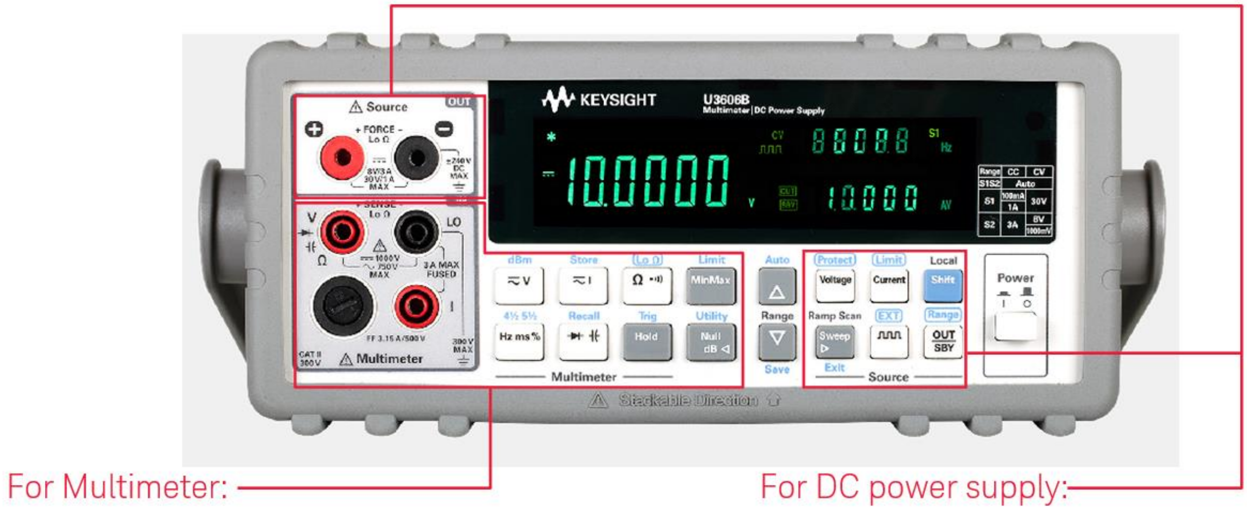

Figure 3. Front panel of the U3606B.

Full-featured 5 ½ digit DMM

- 120,000 counts resolution
- Low error rate of up to 0.025% basic DCV accuracy
- 10 measurement functions (DCV, ACV, DCI, ACI, 2- and 4-wire resistance, frequency, continuity, diode, capacitance)
- 8 built-in math functions
- 4-wire milliohm measurement with 0.001 mΩ resolution
- Multimeter operation keys

Full-featured 30-W DC supply

- 30 V/1 A and 8 V/3 A (for U3606A)
- 30 V/1 A, 100 mA/30 V, 8 V/3 A and 1000 mV/3 A (for U3606B)
- Excellent line/load regulation of up to 0.01%+3 mV
- OVP and OCP load protection
- Auto ramp and scan for multi-level DC bias testing
- Up to 4.8 kHz square-wave output for digital circuit troubleshooting

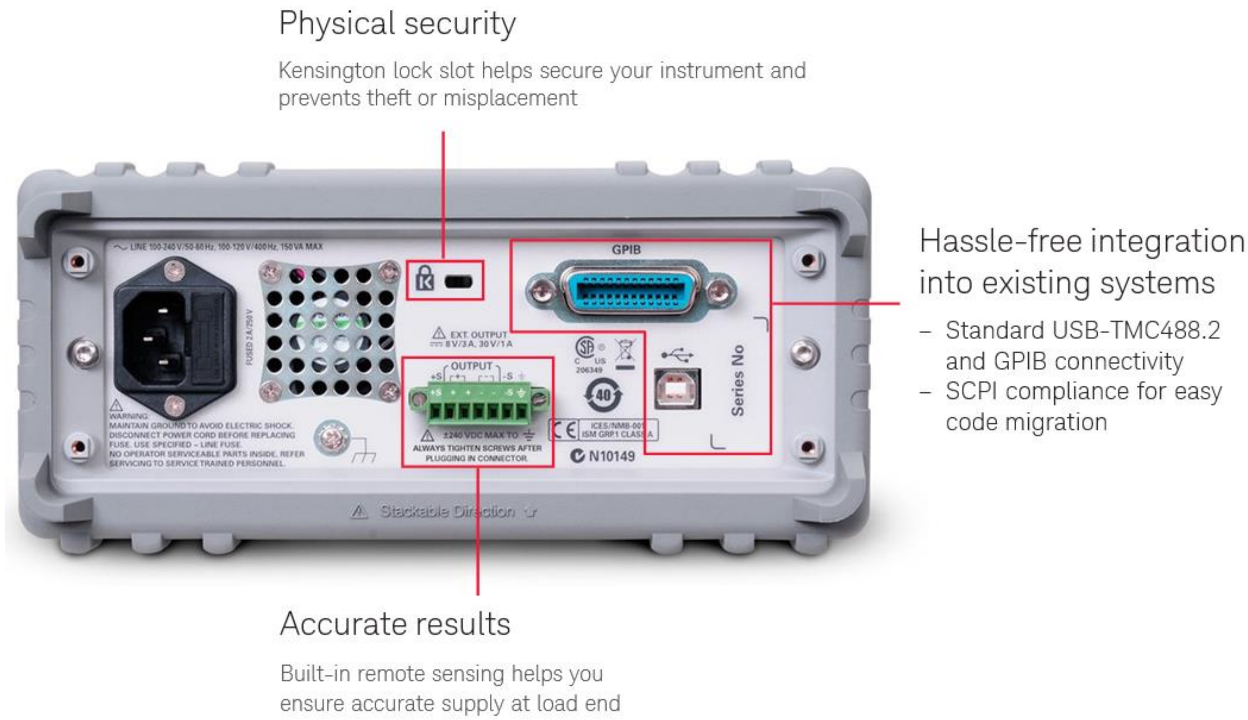

Figure 4. Rear panel of the U3606B.

Digital Multimeter Specifications

Specification assumptions:

- Specifications stated are after 60 minutes of warm-up and for 5½-digit resolution
- One-year calibration cycle, with calibration temperature of 23 °C ± 2 °C
- Operating temperature: 18 to 28 °C (64.4 to 82.4 °F)
- Accuracy is expressed as ± (% of reading + % of range)
- Temperature coefficient: Add [0.1 x (the applicable accuracy) / °C] for 0 to 18 °C and 28 to 55 °C. Unless stated otherwise.
- Relative humidity (RH) up to 80% at 40 °C, proportional to 50% for 40 to 55 °C

DC specifications

Table 1. DC accuracy specifications ± (% of reading + % of range)

Function	Range[1]	Resolution	Test current or burden voltage	24 hours[2] 23 °C ± 1 °C	90 days 23 °C ± 5 °C	1 year 23 °C ± 5 °C	Temperature coefficient/°C 0 to 18 °C 28 to 55 °C
DC voltage	19.9999 mV	0.1 µV	—	0.012 + 0.04	0.015 + 0.04	0.025 + 0.04	0.0015 + 0.0040
	100.000 mV	1 µV	—	0.012 + 0.008	0.015 + 0.008	0.025 + 0.008	0.0015 + 0.0008
	1.00000 V	10 µV	—	0.012 + 0.005	0.015 + 0.005	0.025 + 0.005	0.0010 + 0.0005
	10.0000 V	100 µV	—	0.012 + 0.005	0.015 + 0.005	0.025 + 0.005	0.0020 + 0.0005
	100.000 V	1 mV	—	0.012 + 0.005	0.015 + 0.005	0.025 + 0.005	0.0015 + 0.0005
	1000.00 V	10 mV	—	0.012 + 0.005	0.015 + 0.005	0.025 + 0.005	0.0015 + 0.0005
DC current[3]	10.0000 mA	0.1 µA	< 0.2 V	0.05 + 0.015	0.05 + 0.015	0.05 + 0.015	0.0060 + 0.0005
	100.000 mA	1 µA	< 0.2 V	0.05 + 0.005	0.05 + 0.005	0.05 + 0.005	0.0060 + 0.0005
	1.00000 A	10 µA	< 0.3 V	0.05 + 0.007	0.05 + 0.007	0.15 + 0.007	0.0100 + 0.0005
	3.0000 A	100 µA	< 0.7 V	0.05 + 0.007	0.05 + 0.007	0.15 + 0.007	0.0150 + 0.0010
Resistance[4]	100.000 Ω	1 mΩ	0.83 mA	0.04 + 0.008	0.04 + 0.008	0.05 + 0.008	0.0050 + 0.0005
	1000.00 Ω	10 mΩ	0.83 mA	0.04 + 0.005	0.04 + 0.005	0.05 + 0.005	0.0050 + 0.0005
	10.0000 kΩ	100 mΩ	100 µA	0.04 + 0.005	0.04 + 0.005	0.05 + 0.005	0.0050 + 0.0005
	100.000 kΩ	1 Ω	10 µA	0.04 + 0.005	0.04 + 0.005	0.05 + 0.005	0.0050 + 0.0005
	1.00000 MΩ	10 Ω	900 nA	0.05 + 0.005	0.05 + 0.005	0.06 + 0.005	0.0050 + 0.0005
	10.0000 MΩ	100 Ω	205 nA	0.20 + 0.005	0.20 + 0.005	0.25 + 0.005	0.0150 + 0.0005
	100.000 MΩ	1 kΩ	205 nA || 10 MΩ	1.60 + 0.005	1.60 + 0.005	2.00 + 0.005	0.1500 + 0.0005
Low-resistance[5]	100 mΩ	0.01/0.001 mΩ	1,0000 A	—	—	0.25 + 0.05	—
	1000 mΩ	0.1/0.01 mΩ	100.00 mA	—	—	0.25 + 0.03	—
	10 Ω	1/0.1 mΩ	100.00 mA	—	—	0.09 + 0.03	—
	100 Ω	10/1 mΩ	10.00 mA	—	—	0.09 + 0.03	—
	1000 Ω	0.1/10 mΩ	10.00 mA	—	—	0.09 + 0.03	—
Continuity	1.0000 kΩ	100 mΩ	0.83 mA	0.04 + 0.005	0.04 + 0.005	0.05 + 0.005	0.0050 + 0.0005
Diode[6]	1.0000 V	0.0001 V	0.83 mA	0.04 + 0.005	0.04 + 0.005	0.05 + 0.005	0.0050 + 0.0005
Capacitance[7]	1.000 nF	0.001 nF	0.75 µA current source	—	—	2.0 + 0.8	0.02 + 0.001
	10.00 nF	0.01 nF	0.75 µA	—	—	1.0 + 0.5	0.02 + 0.001
	100.00 nF	0.1 nF	8.3 µA	—	—	1.0 + 0.5	0.02 + 0.001
	1.000 µF	0.001 µF	83 µA	—	—	1.0 + 0.5	0.02 + 0.001
	10.00 µF	0.01 µF	83 µA	—	—	1.0 + 0.5	0.02 + 0.001
	100.0 µF	0.1 µF	83 µA	—	—	1.0 + 0.5	0.02 + 0.001
	1000 µF	1 µF	0.83 mA	—	—	1.0 + 0.5	0.02 + 0.001
	10000 µF	1 µF	0.83 mA	—	—	2.0 + 0.5	0.02 + 0.001

1. 20% over-range on all ranges, except for 1000 V_{dc} range.
2. Relative to calibration standards.
3. Any current measurement greater than 500 mA will have a temporary thermo-effect. If you wish to measure a lower current or offset current immediately after a high-current measurement, ensure that the U3606A has cooled down.
4. Specifications stated are for 2-wire resistance measurements using Null math operation. Without Null, add a 0.2 Ω error. To eliminate noise interference which may be induced by the test leads, a shielded test cable is recommended for resistances above 100 kΩ.
5. Specifications stated are for 4-wire low-resistance measurements. The test current is sent from the FORCE terminals and the resistance is measured by the SENSE terminals. The contact strength may influence the measuring result significantly. Ensure that the connection of the test point is firm to avoid resistance due to contact leads. The accuracy is specified after source compensation due to environment temperature changes. Initiate the compensation by exiting and entering the Lo-Ω function or by disabling and enabling the output. The measuring current will be reduced automatically when the product of the test current and resistance exceed 7.5 V. Refer to the test current and resistance as shown below:

Test current	Maximum test resistance	Test current	Maximum test resistance
4 mA	< 1200 Ω	8 mA	< 938 Ω
5 mA	< 1200 Ω	9 mA	< 834 Ω
6 mA	< 1200 Ω	10 mA	< 750 Ω
7 mA	< 1072 Ω	—	—

6. Specifications stated are for the voltage measured at the input terminals only. The test current (1 mA) is typical. Variation in the current source will create some variation in the voltage dropped across a diode junction.
7. Specifications stated are for open test lead measurements and film capacitor or better using the Null math operation.

For the total measurement accuracy, add the probe error. The contact strength will significantly influence the measuring result. Ensure proper contact at the test point you want to measure.

AC specifications

Table 2. AC accuracy specifications ± (% of reading + % of range)

Function	Range[1]	Frequency range	1 year 23 °C ± 5 °C	Temperature coefficient /°C 0 to 18 °C 28 to 55 °C
	100.000 mV [3]	20 to 45 Hz 45 Hz to 10 kHz 10 to 30 kHz 30 to 100 kHz [4]	1 + 0.1 0.2 + 0.1 1.5 + 0.3 5 + 0.3	0.02 + 0.02 0.02 + 0.02 0.02 + 0.02 0.02 + 0.02
True rms AC voltage[2]	1.00000 V to 750.00 V [5, 6]	20 to 45 Hz [7] 45 Hz to 10 kHz 10 to 30 kHz 30 to 100 kHz4, [8]	1 + 0.1 0.2 + 0.1 1 + 0.1 3 + 0.2	0.02 + 0.02 0.02 + 0.02 0.02 + 0.02 0.02 + 0.02
True rms AC current	10.0000 mA to 3.0000 A [9]	20 to 45 Hz 45 Hz to 1 kHz 1 to 10 kHz	1.5 + 0.1 [10] 0.5 + 0.1 2 + 0.2 [11]	0.02 + 0.02 0.02 + 0.02 0.02 + 0.02

1. 20% over range on all ranges, except for 750 V_{ac} range.
2. Specifications stated are for input signals greater than 5% of range except for the 100 mV range. No square-wave outputs are to be used as the signal output.
3. 100 mV range: specifications stated are for input signals greater than 10% of range.
4. Additional error 0.003% of full scale per kHz to be added when signal input changes less than 10% of range.
5. Available ranges: 1.00000 V, 10.0000 V, 100.000 V, 750.00 V.
6. For 750 V range: 847 V is readable.
7. For 750 V range: the accuracy is specified for input less than 200 V_{rms}.
8. For 750 V range: the accuracy is specified for input less than 300 V_{rms}.
9. Available ranges: 10.0000 mA, 100.000 mA, 1.00000 A, 3.0000 A.
10. For 3 A range: the accuracy is specified for input less than 3 A.
11. For 1 A and 3 A ranges: the accuracy is specified for frequencies less than 5 kHz.

The specification of the AC+DC measurement will be the sum of the AC and DC accuracy. The frequency range will be from 50 Hz for 5½ digit resolution and 225 Hz for 4½ digit resolution.

Frequency specifications

Table 3. Frequency accuracy specifications ± (% of reading + % of range)

Function	Range	Frequency range	1 year 23 °C ± 5 °C	Temperature coefficient/°C 0 to 18 °C 28 to 55 °C
Frequency[1]	Voltage path: 100 mV to 750 V	< 2 Hz < 20 Hz 20 Hz to 100 kHz 100 to 300 kHz	0.18 + 0.003 0.04 + 0.003 0.02 + 0.003 0.02 + 0.003	0.005 0.005 0.005 0.005
	Current path:10 mA to 3 A	< 2 Hz < 20 Hz 20 Hz to 10 kHz	0.18 + 0.003 0.04 + 0.003 0.02 + 0.003	0.005 0.005 0.005

1. For 100 mV and 1 V ranges, the measurable frequency is up to 1 MHz at 0.5 V signal. Minimum input frequency is 1 Hz.

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

Table 4. Frequency sensitivity for voltage measurement

	Minimum sensitivity (rms sine wave)		
Input range[1]	20 Hz to 100 kHz	100 to 300 kHz	300 kHz to 1 MHz
100 mV 1.0 V 10 V 100 V 750 V	50 mV 100 mV 1 V 10 V 100 V	50 mV 120 mV 1.2 V 12 V –	0.5 V 0.5 V — — —

1. Maximum input for specified accuracy = 10 × range or 750 V_{rms} or 1000 V_{dc}.

Table 5. Frequency sensitivity for current measurement

	Minimum sensitivity (rms sine wave)
Input range	20 Hz to 10 kHz
10 mA 100 mA 1.000 A 3 A	1 mA 10 mA 100 mA 300 mA

Duty cycle and pulse width specifications [3]

Table 6. Duty cycle and pulse width resolution and accuracy

Function	Range	Resolution	Accuracy of full scale
Duty cycle	100.000%[1]	0.001%	0.3% + 0.2% per kHz
Pulse width	199.999 ms[2] 1999.99 ms[2]	0.001 ms 0.01 ms	Duty cycle/frequency Duty cycle/frequency

1. The range is from {10 µs × frequency × 100%} to {[1 – (10 µs × frequency)] × 100%}. For example, a 1 kHz signal can be measured from 1% to 99%.
2. The positive or negative pulse width must be greater than 10 µs. The range of the pulse width is determined by the frequency of the signal.
3. Specifications applied for signals with rising time and fall time < 1 µs.

Operating specifications

Table 7. Reading speed (typical)[1]

Function	Rate	Reading speed[2] (readings/second)	Reading speed over USB[3] (readings/second)	Reading speed over GPIB[4] (readings/second)
DC voltage (10 V)	Slow (5½ digits) Fast (4½ digits)	17 70	8 23	8 22
DC current (1 A)	Slow (5½ digits) Fast (4½ digits)	17 70	8 26	8 24
AC voltage (10 V at 1 kHz)	Slow (5½ digits) Fast (4½ digits)	17 70	8 23	8 22
AC current (1 A at 1 kHz)	Slow (5½ digits) Fast (4½ digits)	17 70	8 26	8 24
AC + DC voltage (10 V at 1 kHz)	Slow (5½ digits) Fast (4½ digits)	4 17	2.9 10	2.9 10
AC + DC current (1 A at 1 kHz)	Slow (5½ digits) Fast (4½ digits)	4 17	2.9 10	2.9 10
Resistance (100 kΩ)	Slow (5½ digits) Fast (4½ digits)	17 70	8 22	8 22
Lo-Ω (1 kΩ)	Slow (5½ digits) Fast (4½ digits)	17 70	0.8 0.8	0.8 0.8
Capacitance (10 µF)	Slow/Fast (3½ digits)	5	1.4	1.4
Diode (1 V)	Slow/Fast (4½ digits)	70	26	23
Frequency (voltage path at 10 V, 1 kHz)	Slow (5½ digits) Fast (4½ digits)	9 9	8 8	8 8

Function	Rate	Reading speed[2] (readings/second)	Reading speed over USB[3] (readings/second)	Reading speed over GPIB[4] (readings/second)
Frequency (current path at 1 A, 1 kHz)	Slow (5½ digit) Fast (4½ digit)	9 9	8 8	8 8

1. Based on an average of 500 readings.
2. Reading rate of the A/D converter.
3. Number of measurements per second that can be read through USB using SCPI “READ?” command.
4. Number of measurements per second that can be read through GPIB using SCPI “READ?” command.

Supplemental characteristics

DC voltage	
Measurement method	Sigma Delta A-to-D converter
Maximum input voltage	1000 V_{dc} on all ranges
Input impedance	10 MΩ ± 2% range (typical) in parallel with capacitance < 120 pF
Input protection	1000 V_{rms} on all ranges
Response time	Approximately 0.15 s when the displayed reading reaches 99.9% DC value of the tested input signal at the same range

DC current	
Measurement method	Sigma Delta A-to-D converter
Maximum input current	10 mA to 3.0 A DC[1]
Burden voltage and shunt resistance	< 0.2 V, 10 Ω for 10 mA range < 0.2 V, 1 Ω for 100 mA range < 0.3 V, 0.05 Ω for 1 A range < 0.7 V, 0.05 Ω for 3 A range
Input protection	Protected with 3.15 A/500 V, FF fuse
Response time	Approximately 0.15 s when the displayed reading reaches 99.9% DC value of the tested input signal at the same range

1. Any current measurement greater than 500 mA will have a temporary thermo-effect. If you wish to measure a smaller current or offset current measurement immediately after a high current measurement, ensure that the U3606B is cooled down.

AC voltage	
Measurement method	AC coupled true rms
Maximum input voltage	750 V_{rms}/1200 V_{peak}/3 x 10^7 V-Hz of product
Input impedance	1 MΩ ± 2% range (typical) in parallel with capacitance < 120 pF
Input protection	750 V_{rms} on all ranges
Crest factor	For < 5:1 errors included. Limited by the peak input and 100 kHz bandwidth. Maximum 3.0 at full scale.
Peak input	300% of range. Limited by maximum input.
Response time	Approximately 2.5 s when the displayed reading reaches 99.9% AC rms value of the tested input signal at the same range.
Overload ranging	Will select higher range if peak input overload is detected during auto range. Overload is reported in manual ranging.

AC current	
Measurement method	AC coupled true rms
Maximum input current	10 mA to 3.0 A DC or AC rms[1]
Burden voltage and shunt resistance	< 0.2 V, 10 Ω for 10 mA range < 0.2 V, 1 Ω for 100 mA range < 0.3 V, 0.05 Ω for 1 A range < 0.7 V, 0.05 Ω for 3 A range
Input protection	Protected with 3.15 A/500 V, FF fuse
Crest factor	For < 5:1 errors included. Limited by the peak input and 100 kHz bandwidth. Maximum 3.0 at full scale.
Peak input	300% of range. Limited by maximum input.
Response time	Approximately 2.5 s when the displayed reading reaches 99.9% AC rms value of the tested input signal at the same range.

1. Any current measurement greater than 500 mA will have a temporary thermo-effect. If you wish to measure a smaller current or offset current measurement immediately after a high current measurement, ensure that the U3606B is cooled down.

Resistance	
Measurement method	Two-wire, open-circuit voltage limited to < 5 V
Open circuit voltage	< +5.0 V_{dc}
Input protection	1000 V_{rms} on all ranges, < 0.3 A short circuit
Response time	Approximately 0.15 seconds for 1 MΩ and ranges below 1 MΩ

Low-resistance	
Measurement method	Four-wire, the test current is sent from the FORCE terminals and resistance measured at the SENSE terminals.
Input protection	• FORCE terminals: Protected with a 3.15 A/250 V FF fuse • SENSE terminals: 1000 V_{rms} on all ranges, < 0.3 A short circuit
Open circuit voltage	< +8.6 VDC

Continuity	
Measurement method	0.83 mA ± 0.2% constant current source
Open circuit voltage	< +5.0 V_{dc}
Audible tone	Continuous beeping when reading is less than the threshold resistance of 10 Ω at 1.0 kΩ range
Input protection	1000 V_{rms} on all ranges, < 0.3 A short circuit

Diode	
Measurement method	0.83 mA ± 0.2% constant current source
Open circuit voltage	< +5.0 V_{dc}
Audible tone	Continuous beep when level is below +50 mV DC Single tone for normal forward-biased diode or semiconductor junction where 0.3 V ≤ reading ≤ 0.8 V
Input protection	1000 V_{rms} on all ranges, < 0.3 A short circuit

Capacitance	
Measurement method	Computed from constant current source charge time, typical 0.2 to 1.4 V signal level
Maximum voltage at full scale	• For 1 nF to 10 µF range: < 1.5 V • For 100 µF to 10000 µF: < 0.33 V
Input protection	1000 V_{rms} on all ranges, < 0.3 A short circuit
Response time	Approximately 1 s for 100 µF and ranges below 100 µF
Charge and discharge voltage	5 V_{pp} (approximately from +3 V to –2 V)

Frequency	
Measurement method	Reciprocal counting technique
Signal level	10% of range to full scale input on all ranges
Input protection	• Voltage path: 750 V_{rms} on all ranges • Current path: Protected with 3.15 A/500 V, FF fuse

Maximum display counts (excluding frequency)	
5½ digits	120,000
4½ digits	12,000

Measurement noise rejection	
CMRR (Common Mode Rejection Ratio) for 1 kΩ unbalanced in LO lead	DC: 140 dB AC: 70 dB
NMRR (Normal Mode Rejection Ratio)	**60 Hz ± 0.1%** • 5½ digit: 65 dB • 4½ digit: 0 dB **50 Hz ± 0.1%** • 5½ digit: 55 dB • 4½ digit: 0 dB

DC power supply specifications

Safety considerations

The U3606B is a safety class I instrument, which means it has a protective earth terminal. The terminal must be connected to an earth ground through a power source with a 3-wire ground receptacle.

The DC power supply performance specifications are listed in the following pages. Specifications are warranted in the temperature range of 0 to 55 °C with a fix resistive load. Supplemental characteristics — which are not warranted but are descriptions of performance — are determined either by design or testing.

Specification assumptions

- Specifications stated are after 60-minutes of warm-up and with no load
- Operating temperature at 18 to 28 °C (64.4 to 82.4 °F)
- Accuracy is expressed as ± (% of output + offset) at 23 °C ± 5 °C
- Temperature coefficient: Add [0.1 × (the specified accuracy) / °C] for 0 to 18 °C and 28 to 55 °C
- Relative humidity (RH) up to 80% at 30 °C, proportional to 50% for 30 to 55 °C

Performance specifications

Table 8. DC power supply performance specifications

Parameter		Specifications				
		S1S2	S1	S1m	S2	S2m
Output ratings		AUTO	30 V/1 A	100 mA/30 V	8 V/3 A	1000 mV/3 A
Programming accuracy 1 year (at 23 °C ± 5 °C), ± (% of output + offset)	Voltage	0.05% + 5 mV	0.05% + 5 mV	0.05% + 5 mV	0.05% + 5 mV	0.05% + 5 mV
	Current	0.15% + 3 mA	0.15% + 3 mA	0.15% + 3 mA	0.15% + 3 mA	0.15% + 3 mA
Readback accuracy 1 year over GPIB and USB or front panel with respect to actual output (at 23 °C ± 5 °C), ± (% of output + offset)	Voltage	0.05% + 5 mV	0.05% + 5 mV	0.05% + 5 mV	0.05% + 5 mV	0.05% + 5 mV
	Current	0.15% + 3 mA	0.15% + 3 mA	0.15% + 3 mA	0.15% + 3 mA	0.15% + 3 mA
Ripple and noise With outputs ungrounded, or with either output terminal grounded, 20 Hz to 1 MHz	Normal mode voltage	< 2 mV_{rms}; < 30 mV_{pp}				
	Normal mode current	< 1 mA_{rms}				
Front terminal load regulation[1] ± (% of output + offset)	Voltage	< 3 mV + (6 mV/A)	< 3 mV + (6 mV/A)	< 3 mV + (6 mV/A)	< 3 mV + (6 mV/A)	< 0.3 mV + (6 mV/A)
	Current	< 0.03% + 0.3 mA	< 0.03% +0.3 mA	< 0.03% +0.3 mA	< 0.03% +0.3 mA	< 0.03% +0.3 mA
Rear terminal load regulation ± (% of output + offset)	Voltage	< 0.01% + 3 mV	< 0.01% + 3 mV	< 0.01% + 3 mV	< 0.01% + 3 mV	< 0.01% + 3 mV
	Current	< 0.03% + 0.3 mA	< 0.03% + 0.3 mA	< 0.03% + 0.3 mA	< 0.03% + 0.3 mA	< 0.03% + 0.3 mA
Line regulation	Voltage	3 mV typical	3 mV typical	3 mV typical	3 mV typical	3 mV typical
	Current	1.5 mA typical	1.5 mA typical	1.5 mA typical	1.5 mA typical	1.5 mA typical
Programming resolution	Voltage	1 mV	1 mV	1 mV	1 mV	0.1 mV
	Current	0.1 mA	0.1 mA	0.01 mA	0.1 mA	0.1 mA
Readback resolution	Voltage	1 mV	1 mV	1 mV	1 mV	0.1 mV
	Current	0.1 mA	0.1 mA	0.01 mA	0.1 mA	0.1 mA
Front panel resolution	Voltage	1 mV	1 mV	1 mV	1 mV	0.1 mV
	Current	0.1 mA	0.1 mA	0.01 mA	0.1 mA	0.1 mA
Transient response time		Less than 100 µs for output to recover to within 15 mV following a change in output current from full load to half load or vice versa				
Command processing time		Average time for output voltage to begin to change after receipt of digital data when instrument is connected directly to the USB or GPIB is less than 100 ms				
Over-voltage protection (for CC mode)		Accuracy: 0.5% + 0.5 V Activation time[2]: < 2 ms				
Over-current protection (for CV mode)		Accuracy: 0.5% + 0.05 A Activation time[2]: < 2 ms				

1. The terminal sense is related to the resistance of the contacts or leads, and proportional to the load condition.
2. Average time for the detection of OVP or OCP condition. The output will be dropped down and set to standby within 20 ms.

Supplemental characteristics

Table 9. DC power supply supplemental characteristics

		Characteristics			
Parameter		**S1**	**S1m**	**S2**	**S2m**
Output ratings		**30 V/1 A**	**100 mA/30 V**	**8 V/3 A**	**1000 mV/3 A**
Maximum output programming range	Voltage	CV: 31.500 V OC: 1.05 A OCP: 1.1 A	—	CV: 8.4 V OC: 3.15 A OCP: 3.3 A	CV: 1050 mV OC: 3.15 A OCP: 3.3 A
	Current	CC: 1.05 A OV: 31.500 V OCP: 33.000 V	CC: 105 mA OV: 31.500 V OCP: 33.000 V	CC: 3.15 A OV: 8.4 V OCP: 8.8 V	—
Temperature coefficient ± (% of output + offset) maximum change in output/readback per °C for0 to 18 °C/28 to 55 °C	Voltage	0.005% + 0.5 mV	—	0.005% + 0.5 mV	0.005% + 0.05 mV
	Current	0.02% +1 mA	0.02% +0.01 mA	0.02% +1 mA	—
Remote sensing capability	Voltage drop per load lead	Up to 0.75 V			
	Load regulation	< 0.01% + 3 mV	< 0.01% + 3 mV	< 0.01% + 3 mV	< 0.01% + 0.3 mV
	Maximum load voltage	Subtract voltage drop per load lead			
Voltage programming speed (excludes command processing time)	Full load	Up: 50 ms Down: 50 ms			
	No load	Up: 50 ms Down: 50 ms			

Square-wave output characteristics

Table 10. Square-wave output characteristics

Parameter	Range	Characteristics
Amplitude accuracy ± (offset)	S1 (30 V/1 A) and S1S2 (AUTO)	0.2 V
	S2 (8 V/3 A) and S1S2 (AUTO)	0.2 V
Amplitude resolution	S1 (30 V/1 A)	1 mV
	S2 (8 V/3 A)	1 mV
Frequency accuracy± (% of frequency setting + offset)	(27 steps[1])	0.005% + 0.01 Hz
Frequency resolution	—	0.01 Hz
Duty cycle accuracy ± (% of duty cycle setting)	(256 steps: 0.39% to 99.60%)	0.4%[2, 3]
Duty cycle resolution	—	0.39%[3]
Pulse width accuracy3,4	(256 steps: 1/frequency)	Duty cycle/frequency

Parameter	Range	Characteristics
± (offset)		
Pulse width resolution	—	Range/256

1. Available frequencies: 0.5, 2, 5, 6, 10, 15, 25, 30, 40, 50, 60, 75, 80, 100, 120, 150, 200, 240, 300, 400, 480, 600, 800, 1200, 1600, 2400, 4800 (Hz). If range S1S2 (AUTO) is selected, available frequencies range is 10 to 4800 Hz, with fixed 50% duty cycle:

Output	Range	Adjustable step	Accuracy
Frequency	10.0 Hz to 4800.0 Hz	10 Hz/100 Hz/1000 Hz around	0.005% + 0.1 Hz (according to the display of frequency indication)

2. For frequency signals greater than 100 Hz, an additional 0.1% per 100 Hz is added. The accuracy of the duty cycle should be calculated as:
   Accuracy = (0.4% + [(frequency/100 – 1) × 0.1%])
   Calculation example: Frequency setting = 4800 Hz, Duty cycle setting = 50%
   Characteristic of duty cycle = ± 0.4% + [(4800/100 – 1) × 0.1%] = ± 5.1%
   The duty cycle accuracy (for frequency setting 4800 Hz) is calculated as 50% ± 5.1%.

3. Characteristic applies when the positive or negative pulse width is greater than 50 µs.
4. For frequency signals greater than 100 Hz, an additional 0.1% per 100 Hz is added. The accuracy of the pulse width should be calculated as
   Accuracy = (0.4% + [(frequency/100 – 1) × 0.1%]) / frequency
   Calculation example: Frequency setting = 4800 Hz, Duty cycle setting = 50%
   Characteristic of pulse width = ± (0.4% + [(4800/100) – 1) × 0.1%]) × 1/4800 = ± 10.625 µs
   The pulse width accuracy (for frequency setting 4800 Hz and duty cycle setting 50%) is calculated as 0.1042 ms ±10.625 µs.

The rise and fall time are 25 µs typically between 10% and 90% of the signal amplitude.

The additional load regulation is 0.15 V/A.

Sweep characteristics

Table 11. Scan output characteristics

Scan	Constant voltage			Constant current		
Range	**S1**	**S2**	**S2m**	**S1**	**S1m**	**S2**
Maximum amplitude[1]	31.500 V	8.400 V	1050.0 mV	1.0500 A	105.00 mA	3.1500 A
Step	1 step to 100 steps			1 step to 100 steps		
Dwelling time	1 s to 99 s			1 s to 99 s		

1. Amplitude start position is fixed at 0 (V or A) by default.

Table 12. Ramp output characteristics

Ramp	Constant voltage			Constant current		
Range	**S1**	**S2**	**S2m**	**S1**	**S1m**	**S2**
Maximum amplitude[1]	31.500 V	8.400 V	1050.0 mV	1.0500 A	105.00 mA	3.1500 A
Step	1 step to 10000 steps			1 step to 10000 steps		
Dwelling time	100 ms (typical) per step			100 ms (typical) per step		

1. Amplitude start position is fixed at 0 (V or A) by default.

Product characteristics

	–
Power supply	• Universal 100 V_{ac} to 240 V_{ac} ±10% • AC line frequency of 45 to 66 Hz; 360 to 440 Hz for 100/120 V operation
Power consumption	150 VA maximum
Current input fuse	3.15 A, 500 V FF fuse (on front panel)
Display	Highly visible vacuum-fluorescent display (VFD)
Operating environment	• Operating temperature from 0 to +55 °C • Relative humidity up to 80% RH at 40 °C (non-condensing) • Full accuracy to 40% RH for 41 °C to 55 °C (non-condensing) • Altitude up to 2000 meters • Pollution degree 2 • For indoor use only
Storage compliance	–40 to 70 °C
Safety and EMC compliance	• Refer to Declaration of Conformity for the latest revisions of regulatory compliance at www.keysight.com/go/conformity
Shock and vibration	Tested to IEC/EN 60068-2
Remote interface	• GPIB IEEE-488 compatible • Full Speed USB 2.0 (Standard-A to Type B) • USB-TMC 488.2 Class device compatible • USB-CDC
Measurement category	• CAT II 300 V • CAT I 1000 V_{dc}, 750 V_{ac} rms • 2500 V_{pk} transient over-voltages
Dimensions (W × H × D)	• 226 × 105 × 334 mm (with rubber bumpers) • 215 x 87 x 312 mm (without rubber bumpers)
Weight	• 3.77 kg approximate (with rubber bumpers) • 3.54 kg approximate (without rubber bumpers)

Optional accessories

Accessories available	
11059A	Kelvin probe set
11062A	Kelvin clip set
34133A	Precision electronic test leads (for DMM function)
34136A	40 kV high-voltage probe (for DMM function)
34330A	30-A current shunt (for DMM function)
U8201A	combo test lead kit
U8202A	electronic test lead kit (for DMM function)
34190A	Rackmount Kit
34191A	2U Dual Flange Kit
34194A	Dual Lock Link Kit
E3600A-100	Test Lead Kit (for DC power supply function)

Ordering information

Standard shipped items

- Quick Start Guide
- Certificate of Calibration
- U8201A Combo Test Lead Kit
- USB 2.0 High-Speed Type-A to Type-B cable
- AC power cord

I/O connectivity options

For control via GPIB interface

- 82350B/82351A PCI/PCIe high-performance GPIB interface card
- 82357B USB/GPIB converter
- E5810B LAN/GPIB gateway
- 10833D/A/B/C/F/G GPIB cables
- 10834A GPIB-to-GPIB adapter

For control via USB interface

E5813A networked 5-port USB hub

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