2306-VS Dual Channel Battery/Charger Simulator

OUTPUT #1 (BATTERY)

DC VOLTAGE OUTPUT (2 YEARS, 23°C ± 5°C)

OUTPUT VOLTAGE: 0 to +15VDC.

OUTPUT ACCURACY: ±(0.05% + 3mV).

PROGRAMMING RESOLUTION: 1mV.

READBACK ACCURACY[1]: ±(0.05% + 3mV).

READBACK RESOLUTION: 1mV.

LOAD REGULATION: ±(0.01% + 2mV).

LINE REGULATION: ±(0.5mV).

STABILITY[2]: ±(0.01% + 0.5mV).

MEASUREMENT TIME CHOICES: 0.01 to 10 PLC[7], in 0.01PLC steps.

AVERAGE READINGS: 1 to 10.

READING TIME[1, 8, 9]: 31ms, typical.

TRANSIENT RESPONSE:	High Bandwidth	Low Bandwidth
Transient Recovery Time[13]	<40µs[3] or <60µs[4]	<80µs[3] or <100µs[4]
Transient Voltage Drop	<75mV[3] or <100mV[4]	<250mV[3] or <400mV[4]

REMOTE SENSE: 1V max. drop in each lead. Add 2mV to the voltage load regulation specification for each 1V change in the negative output lead due to load current change. Remote sense required. Integrity of connection continually monitored. If compromised, output will turn off automatically once settable window (±0 to ±8 volts) around normal voltage exceeded.

VARIABLE OUTPUT IMPEDANCE

RANGE: 0 to 1.00Ω in 0.01Ω steps. Value can be changed with output on if trigger external disabled on channel.

DC CURRENT (2 YEARS, 23°C ± 5°C)

CONTINUOUS AVERAGE OUTPUT CURRENT:

Channel #2 (Charger) OFF: I = 50W/(Vset channel 1 + 6V); 5A max.

Channel #2 (Charger) ON: I = (50W – Power consumed by channel #2)/(Vset channel 1 + 6V); 5A max.

The power consumed by channel #2 is calculated as:

Channel #2 sourcing current:

Power consumed = (Vset channel 2 + 6V) x (current supplied)

Channel #2 sinking current:

Power consumed = 5 x (sink current)

Peak currents can be a maximum of 5A provided the average current is within the above limits.

CONTINUOUS AVERAGE SINK CURRENT:

Channel #2 (Charger) OFF:

0–5V: 3A max.

5–15V: Derate 0.2A per volt above 5V. Compliance setting controls sinking.

Channel #2 (Charger) ON:

Available current = (50W – Power consumed by channel #2)/5; 3A max. (0–5V). Derate 0.2A per volt above 5V.

SOURCE COMPLIANCE ACCURACY: ±(0.16% + 5mA)[5].

PROGRAMMED SOURCE COMPLIANCE RESOLUTION: 1.25mA.

READBACK ACCURACY[1]: **5A Range:** ±(0.2% + 200µA). **5mA Range:** ±(0.2% + 1µA).

READBACK RESOLUTION: **5A Range:** 100µA. **5mA Range:** 0.1µA.

LOAD REGULATION: ±(0.01% + 1mA).

LINE REGULATION: ±(0.5mA).

STABILITY[4]: ±(0.01% + 50µA).

MEASUREMENT TIME CHOICES: 0.01 to 10 PLC[7], in 0.01PLC steps.

AVERAGE READINGS: 1 to 10.

READING TIME[1, 8, 9]: 31ms, typical.

PULSE CURRENT MEASUREMENT OPERATION

TRIGGER LEVEL: **5A Range:** 5mA to 5A, in 5mA steps. **1A Range:** 1mA to 1A, in 1mA steps. **100mA Range:** 0.1mA to 100mA, in 100µA steps.

TRIGGER DELAY: 0 to 100ms, in 10µs steps.

INTERNAL TRIGGER DELAY: 15µs.

HIGH/LOW/AVERAGE MODE:

Measurement Aperture Settings: 33.3µs to 833ms, in 33.3µs steps.

Average Readings: 1 to 100.

PULSE CURRENT MEASUREMENT ACCURACY[11] (2 Years, 23°C ±5°C):

Aperture	Accuracy ±(% reading + offset + rms noise[10])
<100 µs	0.2% + 900 µA + 2mA
100 µs – 200 µs	0.2% + 900 µA + 1.5mA
200 µs – 500 µs	0.2% + 900 µA + 1mA
500 µs – <1 PLC	0.2% + 600 µA + 0.8mA
1 PLC[12]	0.2% + 400 µA + 0mA
>1 PLC	0.2% + 400 µA + 100µA

BURST MODE CURRENT MEASUREMENT

MEASUREMENT APERTURE: 33.3µs to 833ms, in 33.3µs steps.

CONVERSION RATE: 3650/second at 33.3µs meas. aper., typical.

INTERNAL TRIGGER DELAY: 15µs with 33µs.

NUMBER OF SAMPLES: 1 to 5000.

TRANSFER SAMPLES ACROSS IEEE BUS IN BINARY MODE: 4800 bytes/s, typical.

LONG INTEGRATION MODE CURRENT MEASUREMENT

MEASUREMENT TIME[6]: 850ms (840ms) to 60 seconds in 1ms steps.

DIGITAL VOLTMETER INPUT (2 YEARS, 23°C ± 5°C)

INPUT VOLTAGE RANGE: –5 to +30VDC.

INPUT IMPEDANCE: 2MΩ typical.

MAXIMUM VOLTAGE (either input terminal) WITH RESPECT TO OUTPUT LOW: –5V, +30V.

READING ACCURACY[1]: ±(0.05% + 3mV).

READING RESOLUTION: 1mV.

CONNECTOR: HI and LO input pair part of Output #1's terminal block.

MEASUREMENT TIME CHOICES: 0.01 to 10 PLC[7], in 0.01PLC steps.

AVERAGE READINGS: 1 to 10.

READING TIME[1, 8, 9]: 31ms, typical.

VOLTAGE SETTLING TIMES

Voltage Step Settling Times - Typical

Increasing Voltage	10-90% Rise Time	Settling Time
Voltage step ≤ 7V	50µs	300µs
Voltage step > 7V	50µs to 1.2ms	300µs to 1.8ms

Decreasing Voltage	10-90% Fall Time	Settling Time
0V < Voltage step < 15V	50µs to 250µs	300µs

NOTE: Times are under no load condition and settling times defined at +/- 2% of step size.

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OUTPUT #2 (CHARGER)

DC VOLTAGE OUTPUT (2 YEARS, 23°C ± 5°C)

OUTPUT VOLTAGE: 0 to +15VDC.

OUTPUT ACCURACY: ±(0.05% + 10mV).

PROGRAMMING RESOLUTION: 10mV.

READBACK ACCURACY[1]: ±(0.05% + 3mV).

READBACK RESOLUTION: 1mV.

OUTPUT VOLTAGE SETTLING TIME: 5ms to within stated accuracy.

LOAD REGULATION: ±(0.01% + 2mV).

LINE REGULATION: ±(0.5mV).

STABILITY[2]: ±(0.01% + 0.5mV).

MEASUREMENT TIME CHOICES: 0.01 to 10 PLC[7], in 0.01PLC steps.

AVERAGE READINGS: 1 to 10.

READING TIME[1, 8, 9]: 31ms, typical.

TRANSIENT RESPONSE:	**High Bandwidth**	**Low Bandwidth**
Transient Recovery Time[13]	<50µs[3] or <80µs[4]	<60µs[3] or <100µs[4]
Transient Voltage Drop	<120mV[3] or <150mV[4]	<160mV[3] or <200mV[4]

REMOTE SENSE: 1V max. drop in each lead. Add 2mV to the voltage load regulation specification for each 1V change in the negative output lead due to load current change. Remote sense required. Integrity of connection continually monitored. If compromised, output will turn off automatically once settable window (±0 to ±8 volts) around normal voltage exceeded.

DC CURRENT (2 YEARS, 23°C ± 5°C)

CONTINUOUS AVERAGE OUTPUT CURRENT:

Channel #1 (Battery) OFF:
I = 50W/(Vset channel 2 + 6V); 5A max.

Channel #1 (Battery) ON:
I = (50W – Power consumed by channel #1)/(Vset channel 2 + 6V); 5A max.
The power consumed by channel #1 is calculated as:
Channel #1 sourcing current:
Power consumed = (Vset channel 1 + 6V) x (current supplied)
Channel #1 sinking current:
Power consumed = 5 x (sink current)
Peak currents can be a maximum of 5A provided the average current is within the above limits.

CONTINUOUS AVERAGE SINK CURRENT:

Channel #1 (Battery) OFF:
0–5V: 3A max.
5–15V: Derate 0.2A per volt above 5V. Compliance setting controls sinking.

Channel #1 (Battery) ON:
Available current = (50W – Power consumed by channel #1)/5; 3A max. (0–5V).
Derate 0.2A per volt above 5V.

SOURCE COMPLIANCE ACCURACY: ±(0.16% + 5mA)[5].

PROGRAMMED SOURCE COMPLIANCE RESOLUTION: 1.25mA.

READBACK ACCURACY[1]: **5A Range:** ±(0.2% + 200µA).
5mA Range: ±(0.2% + 1µA).

READBACK RESOLUTION: **5A Range:** 100µA.
5mA Range: 0.1µA.

LOAD REGULATION: ±(0.01% + 1mA).

LINE REGULATION: ±(0.5mA).

STABILITY[4]: ±(0.01% + 50µA).

MEASUREMENT TIME CHOICES: 0.01 to 10 PLC[7], in 0.01PLC steps.

AVERAGE READINGS: 1 to 10.

READING TIME[1, 8, 9]: 31ms, typical.

PULSE CURRENT MEASUREMENT OPERATION

TRIGGER LEVEL: 5mA to 5A, in 5mA steps.

TRIGGER DELAY: 0 to 100ms, in 10µs steps.

INTERNAL TRIGGER DELAY: 15µs.

HIGH/LOW/AVERAGE MODE:
Measurement Aperture Settings: 33.3µs to 833ms, in 33.3µs steps.
Average Readings: 1 to 100.

PULSE CURRENT MEASUREMENT ACCURACY[11] (2 Years, 23°C ±5°C):

Aperture	Accuracy ±(% reading + offset + rms noise[10])
<100 µs	0.2% + 900 µA + 2mA
100 µs – 200 µs	0.2% + 900 µA + 1.5mA
200 µs – 500 µs	0.2% + 900 µA + 1mA
500 µs – <1 PLC	0.2% + 600 µA + 0.8mA
1 PLC[12]	0.2% + 400 µA + 0mA
>1 PLC	0.2% + 400 µA + 100µA

BURST MODE CURRENT MEASUREMENT

MEASUREMENT APERTURE: 33.3µs to 833ms, in 33µs steps.

CONVERSION RATE: 2040/second at 33.3µs meas. aper., typical.

INTERNAL TRIGGER DELAY: 15µs with 33µs.

NUMBER OF SAMPLES: 1 to 5000.

TRANSFER SAMPLES ACROSS IEEE BUS IN BINARY MODE: 4800 bytes/s, typical.

LONG INTEGRATION MODE CURRENT MEASUREMENT

MEASUREMENT TIME[6]: 850ms (840ms) to 60 seconds in 1ms steps.

DIGITAL VOLTMETER INPUT (2 YEARS, 23°C ± 5°C)

INPUT VOLTAGE RANGE: –5 to +30VDC.

INPUT IMPEDANCE: 2MΩ typical.

MAXIMUM VOLTAGE (either input terminal) WITH RESPECT TO OUTPUT LOW: –5V, +30V.

READING ACCURACY[1]: ±(0.05% + 3mV).

READING RESOLUTION: 1mV.

CONNECTOR: HI and LO input pair part of Output #2's terminal block.

MEASUREMENT TIME CHOICES: 0.01 to 10 PLC[7], in 0.01PLC steps.

AVERAGE READINGS: 1 to 10.

READING TIME[1, 8, 9]: 31ms, typical.

VOLTAGE SETTLING TIMES

Voltage Step Settling Times – Typical

Increasing Voltage	10-90% Rise Time	Settling Time
Voltage step ≤ 7V	10µs	100µs
Voltage step > 7V	10µs to 1.2ms	100µs to 1.5ms

Decreasing Voltage	10-90% Fall Time	Settling Time
0V < Voltage step < 15V	5µs to 40µs	50µs to 200µs

NOTE: Times are under no load condition and settling times defined at +/- 2% of step size.

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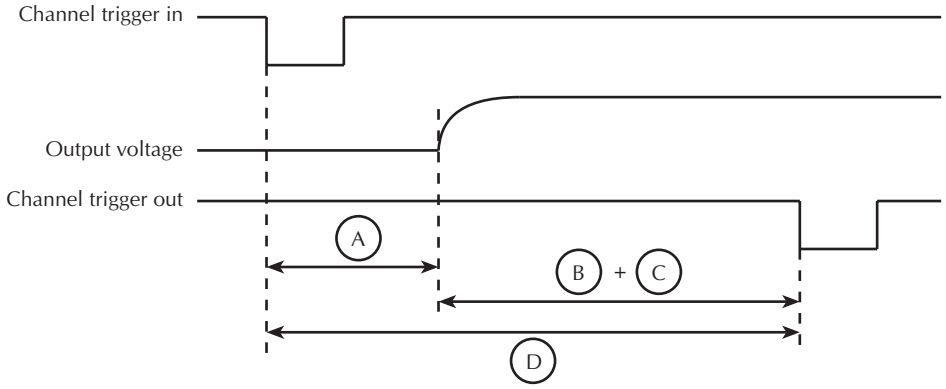
VOLTAGE STEPPING ONLY

TEST CONDITIONS:

1. Trigger external is enabled on both channels.
2. Only a single channel is externally triggered during the sequence while remaining channel stays idle.
3. Times based on 0 programmable user delay.

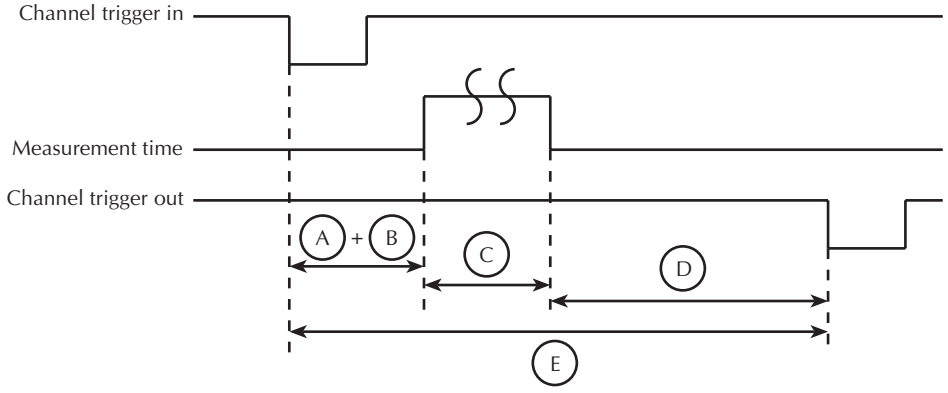


Output #1 (Battery)	Output #2 (Charger)
A = 70µs typical	**A** = 55µs typical
B = 330µs typical	**B** = 545µs typical
C = Programmable user delay (0-5 seconds)	**C** = Programmable user delay (0-5 seconds)
D = 400µs typical with C as 0	**D** = 600µs typical with C as 0

AUTO MEASUREMENT ONLY

TEST CONDITIONS:

1. Trigger external is enabled on both channels.
2. Only a single channel is externally triggered during the sequence while remaining channel stays idle.
3. Times based on 0 programmable user delay.
4. Measurement time = 167µs (0.01 plc).
5. Steps points = 4.



Output #1 (Battery)	Output #2 (Charger)
A = 43µs typical	**A** = 43µs typical
B = Programmable user delay (0-5 seconds)	**B** = Programmable user delay (0-5 seconds)
C = is measurement time	**C** = is measurement time
D = 410µs typical (steps 1, 2, and 3)	**D** = 650µs typical (steps 1, 2, and 3)
E = 620µs typical for steps 1, 2, and 3 with B as 0 8ms typical for step 4 with B as 0	**E** = 860µs typical for steps 1, 2, and 3 with B as 0 8ms typical for step 4 with B as 0

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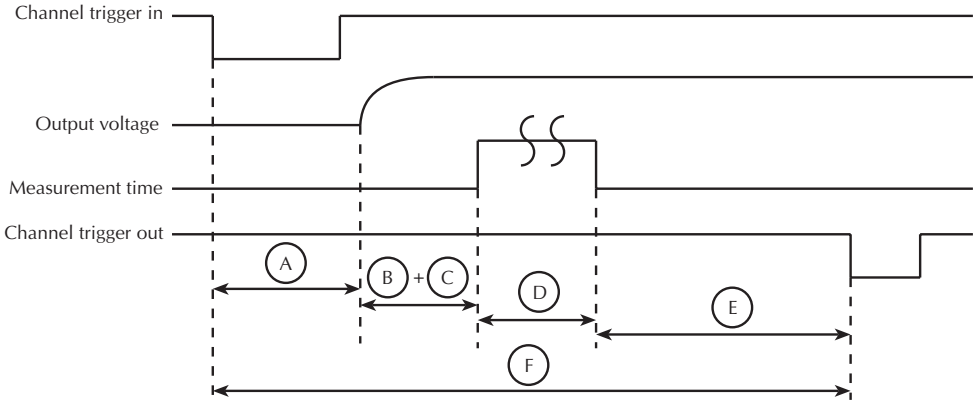
VOLTAGE STEPPING WITH AUTO MEASUREMENT

TEST CONDITIONS:

1. Trigger external is enabled on both channels.
2. Only a single channel is externally triggered during the sequence while remaining channel stays idle.
3. Times based on 0 programmable user delay.
4. Measurement time = 167µs (0.01 plc).
5. Steps points = 4.

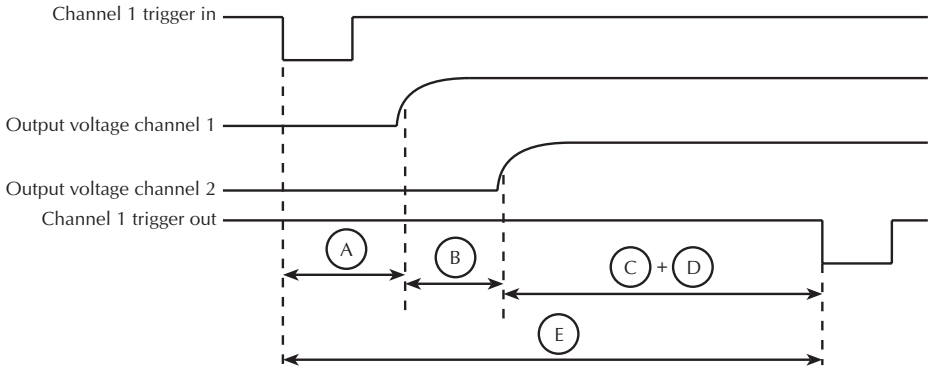


Output #1 (Battery)	Output #2 (Charger)
A = 70µs typical	**A** = 55µs typical within
B = 43µs typical	**B** = 43µs typical within
C = programmable user delay (0-5 seconds)	**C** = programmable user delay (0-5 seconds)
D = measurement time	**D** = measurement time
E = 475µs typical (steps 1, 2, and 3)	**E** = 955µs typical (steps 1, 2, and 3)
F = 755µs typical steps 1, 2 and 3 with C as 0 8ms typical step 4 with C as 0	**F** = 1.22ms typical steps 1, 2 and 3 with C as 0 8ms typical step 4 with C as 0

VOLTAGE STEPPING BOTH CHANNELS WITH CHANNEL 1

TEST CONDITIONS:

1. Only a single channel is externally triggered during the sequence while remaining channel stays idle.
2. Times based on 0 programmable user delay.



Output #1 (Battery)/Output #2(Charger)
A = 70µs typical
B = 55µs typical
C = 775µs typical
D = programmable user delay (0-5 seconds)
E = 900µs typical with D as 0

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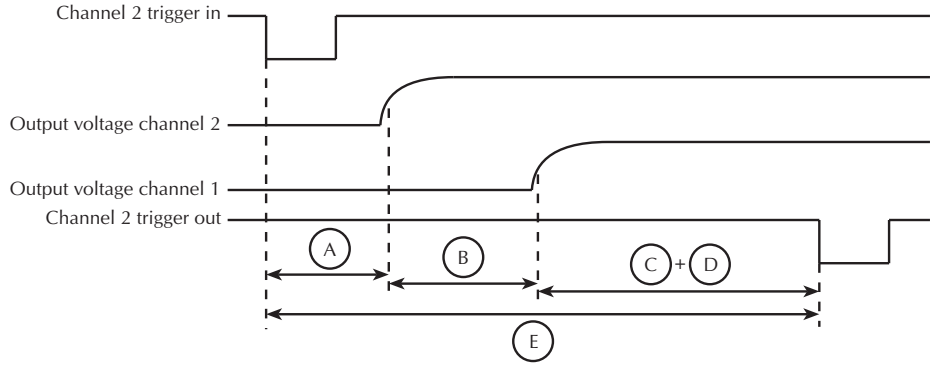
VOLTAGE STEPPING BOTH CHANNELS WITH CHANNEL 2

TEST CONDITIONS:

1. Only a single channel is externally triggered during the sequence while remaining channel stays idle.
2. Times based on 0 programmable user delay.

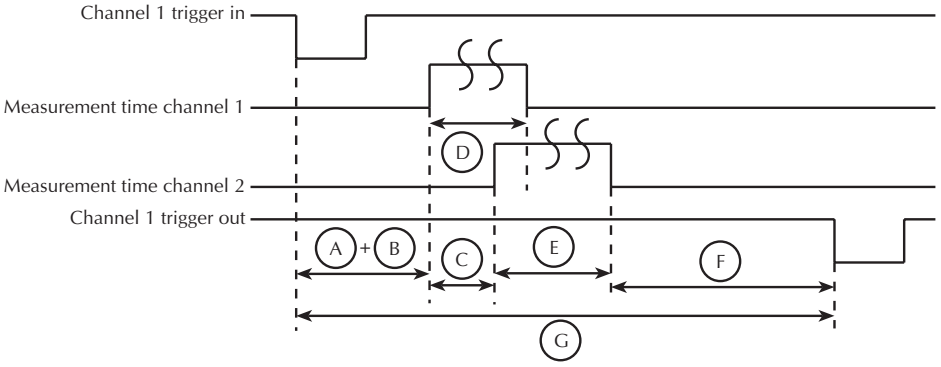


Output #1 (Battery)/Output #2(Charger)
A = 55µs typical
B = 70µs typical
C = 775µs typical
D = programmable user delay (0-5 seconds)
E = 900µs typical with D as 0

AUTO MEASUREMENT BOTH CHANNELS WITH CHANNEL 1

TEST CONDITIONS:

1. Only a single channel is externally triggered during the sequence while remaining channel stays idle.
2. Times based on 0 programmable user delay.
3. Measurement time = 167µs (0.01 plc).
4. Steps points = 4.



Output #1 (Battery)/Output #2(Charger)
A = 43µs typical
B = programmable user delay (0-5 seconds)
C = 18µs typical
D = measurement time channel 1
E = measurement time channel 2
F = 872µs typical with steps 1, 2, and 3
G = 1.1ms typical for steps 1, 2, and 3 with B as 0 16.0ms typical step 4 with B as 0

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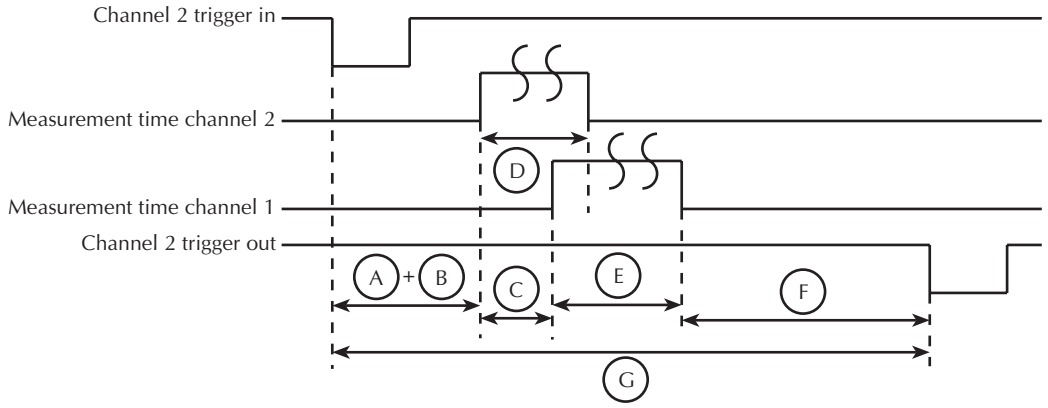
AUTO MEASUREMENT BOTH CHANNELS WITH CHANNEL 2

TEST CONDITIONS:

1. Only a single channel is externally triggered during the sequence while remaining channel stays idle.
2. Times based on 0 programmable user delay.
3. Measurement time = 167µs (0.01 plc).
4. Steps points = 4.

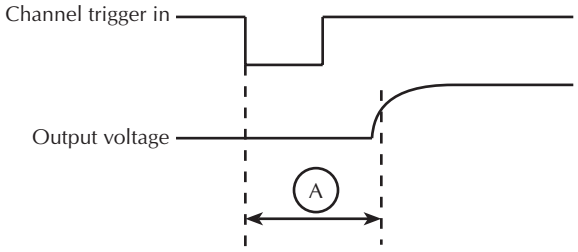


Output #1 (Battery)/Output #2(Charger)
A = 43µs typical
B = programmable user delay (0-5 seconds)
C = 18µs typical
D = measurement time channel 2
E = measurement time channel 1
F = 872µs typical with steps 1, 2, and 3
G = 1.1ms typical for steps 1, 2, and 3 with B as 0 16.0ms typical step 4 with B as 0

VOLTAGE STEPPING WITH SYNC MEASUREMENT

TEST CONDITIONS:

1. Trigger external is enabled on both channels.
2. Only a single channel is externally triggered during the sequence while remaining channel stays idle.
3. Times based on 0 programmable user delay.



Output #1 (Battery)	Output #2 (Charger)
Channel 1 trigger in = output voltage start changing	Channel 2 trigger in = output voltage start changing
A = 70µs typical	**A** = 55µs typical within
4ms typical to start search for desired pulse edge. Time for trigger out dependent on search time for selecting edge, integration time, and storing reading in buffer	

2306-VS Dual Channel Battery/Charger Simulator

GENERAL

ISOLATION (LOW–EARTH): 22VDC max. Do not exceed 60VDC between any two terminals of either connector.

PROGRAMMING: IEEE-488.2 (SCPI).

USER-DEFINABLE POWER-UP STATES: 3.

REAR PANEL CONNECTORS: Two trigger in and two trigger out (BNC) connectors. Two 8-position quick disconnect terminal block for output (4), sense (2), and DVM (2).

TRIGGER IN/OUT CONNECTORS: IN High 3-5V, IN Low ≤0.8V, OUT High >4V, OUT Low <0.8V.

TEMPERATURE COEFFICIENT (OUTSIDE 23°C ±5°C): Derate accuracy specification by (0.1 x specification)/°C.

OPERATING TEMPERATURE: 0° to 50°C (Derate to 70%). 0° to 35°C (Full power).

STORAGE TEMPERATURE: –20° to 70°C.

HUMIDITY: <80% @ 35°C non-condensing.

DISPLAY TYPE: 2-line x 16 character VFD.

DIMENSIONS: 89mm high x 213mm wide x 411mm deep (3½ in x 8⅜ in x 16 5/16 in).

NET WEIGHT: 3.9kg (8.6lbs.)

SHIPPING WEIGHT: 6.4kg (14lbs.)

INPUT POWER: 100–120VAC/220–240VAC, 50 or 60Hz (auto detected at power-up).

POWER CONSUMPTION: 165VA max.

WARRANTY: Two years parts and labor on materials and workmanship.

EMC: Conforms with European Union Directive directive 89/336/EEC, EN 61326.

SAFETY: Conforms with European Union Directive 73/23/EEC, EN 61010-1.

VIBRATION: MIL-PRF-28800F Type III, Class 3

ACCESSORIES SUPPLIED: User and service manual, output connectors mating terminal (part no. CS-846).

1 PLC = 1.00.
2 Following 15 minute warm-up, the change in output over 8 hours under ambient temperature, constant load, and line operating conditions.
3 Remote sense, at output terminals, 0.5A to 5A typical.
4 Remote sense, with 4.5m (15 ft) of 16 gauge (1.31mm2) wire and 1Ω resistance in each lead to simulate typical test environment, 1.5A load change (0.15A to 1.65A).
5 Minimum current in constant current mode is 6mA.
6 60Hz (50Hz).
7 PLC = Power Line Cycle. 1PLC = 16.7ms for 60Hz operation, 20ms for 50Hz operation.
8 Display off.
9 Speed includes measurement and binary data transfer out of GPIB.
10 Typical values, peak-to-peak noise equals 6 times rms noise.
11 Based on settled signal: 100µs pulse trigger delay.
12 Also applies to other apertures that are integer multiples of 1PLC.
13 Recovery to within 20mV of previous level.