VOAC 7513

- ***5-1/2 digits, full-scale 409999***
- ***Max. sample rate 100 times/sec. (at 4-1/2 digits mode)***
- ***High resolution***
  DCV: 0.1 µV, ACV: 1 µV, Ω: 0.1 mΩ
  DCA/ACA: 10 nA, °C: 0.1°C, Hz: 0.1 mHz
- ***TRUE RMS ACV/ACA (DC+AC)V/(DC+AC)A***
- ***Temperature measurement from –200°C to 1600°C***
- ***Frequency measurement of 10 Hz to 400 kHz***
- ***4-wire ohms measurement***
- ***Storage of 3,000 data***
- ***A variety of optional units enhance measuring efficiency.***

Specifications

1. DC VOLTS

Accuracy
Sample rate : SLOW/MID : ± (% of reading + digits)

Range	23±1°C,s 24hr	23±5°C, 90days	23±5°C, one year	Resolution		Input resistance
				Slow,Mid 5-1/2	Fast 4-1/2	
40 mV	0.008 + 10	0.015 + 10	0.025 + 10	0.1 µV	—	≧ 100 MΩ
400 mV	0.0035 + 5	0.008 + 5	0.012 + 5	1 µV	10 µV	≧ 1000 MΩ
4 V	0.0035 + 2	0.008 + 2	0.012 + 2	10 µV	100 µV	
40 V	0.004 + 5	0.012 + 5	0.016 + 5	100 µV	1 mV	≈10 MΩ
400 V	0.004 + 2	0.012 + 2	0.016 + 2	1 mV	10 mV	
1000 V				10 mV	100 mV	

* The accuracy at 23±1°C, and 24 hrs. is relative to the calibration standards.
* The accuracy at 400 mV range is specified after zero compensation through the REL operation.
* Add 0.003% of reading when used with SC-306 battery unit.
* In FAST sample mode, add 5 digits to the accuracy in SLOW and MID sample modes.

Temperature coefficient (0°C to 18°C, 28°C to 50°C)
(1/10 of the accuracy for each range)/°C

Maximum input voltage 40 mV to 4 V range : ±1100 V DC (5sec.)
±500 V DC (continuous)
40 V to 1000 V range : ±1100 V DC (continuous)

Sample rate and noise rejection

Sample rate mode	Reading rate	NMR	CMR
SLOW	≈4 times/sec	>55 dB	≧ 110 dB
MID	≈20 times/sec		
FAST	≈100 times/sec	0 dB	≧ 55 dB

* Reading rates are specified with math function OFF.
* NMR : 50/60 Hz : ±0.1%
* CMR :1 kΩ unbalance, DC, 50/60 Hz : ±0.1%

2. AC VOLTS

Accuracy (For sine wave only) : ±(% of reading + digits)
400 mV to 400 V range : Accuracy is specified for 20,000 counts or more.
750 V range : Accuracy is specified for 10,000 counts or more.

Range	Resolution	Frequency	23±5°C, 90days	23±5°C, one year	Input resistance
400 mV	1 µV	15 Hz–45 Hz	0.5 + 100	0.5 + 150	≈2 MΩ/ 100 pF or below
4 V	10 µV	45 Hz–100 Hz	0.25 + 100	0.25 + 150	
40 V	100 µV	100 Hz–50 kHz	0.2 + 100	0.2 + 150	
400 V	1 mV	50 kHz–100 kHz	0.5 + 300	0.5 + 300	
750 V	10 mV	100 kHz–300 kHz	2.5 + 1000	2.5 + 1000	

* In the 400V range, accuracy is specified at 100 kHz or lower.
* In the 750V range, accuracy is specified at 20 kHz or lower.
* In SLOW sample mode, accuracy is specified at 15 Hz or higher.
* In FAST sample mode, accuracy is specified at 200 Hz or higher.

Temperature coefficient (0°C to 18°C, 28°C to 50°C)
(1/10 of the accuracy for each range)/°C

Maximum input voltage All range : 780 Vrms (continuous), 1100 V peak
AC converter True RMS.

Signals other than sine wave : add the following values to the accuracy of the sine wave.

Frequency	Crest factor		
	1–1.5	1.5–2	2–3
15 Hz~20 kHz	0.05%	0.15%	0.3%
20 kHz~300 kHz	0.2%	—	—

Sample rate

Sample rate mode	Reading rate	Frequency	Response time
SLOW	≈4 times/sec	15 Hz–300 kHz	≧ 2sec
FAST	≈20 times/sec	200 Hz–300 kHz	≧ 1sec

* Response time is the time for meter reading to reach within 100 counts of final value in the same range.

3. RESISTANCE Ω (2WΩ/4WΩ)

Accuracy Sample rate : SLOW/MID : ± (% of reading + digits)

Range	23±1°C, 24hrs	23±5°C, 90days	23±5°C, one year	Resolution		Test current
				Slow,Mid 5-1/2	Fast 4-1/2	
40 Ω	0.01 + 10	0.02 + 10	0.025 + 10	0.1 mΩ	1 mΩ	≈10 mA
400 Ω	0.005 + 3	0.01 + 3	0.014 + 3	1 mΩ	10 mΩ	≈10 mA
4k Ω				10 mΩ	100m Ω	≈1 mA
40 kΩ				100 mΩ	1 Ω	≈100 µA
400 kΩ	0.006 + 3	0.011 + 3	0.015 + 3	1 Ω	10 Ω	≈10 µA
4000 kΩ	0.012 + 10	0.03 + 10	0.033 + 10	10 Ω	100 Ω	≈1 µA
40 MΩ	0.05 + 20	0.2 + 20	0.25 + 20	100 Ω	1 kΩ	≈100 nA
400 MΩ	0.5 + 50	1.5 + 50	1.5 + 50	1 kΩ	10 kΩ	≈10 nA

* The accuracy at 23±1°C, and 24 hrs. is relative to the calibration standards.
* The accuracy at 40 Ω to 4 kΩ ranges are specified after zero compensation through the REL operation.
* Add 0.003% of reading when used with SC-306 battery unit.
* In FAST sample mode, add the following values to the accuracy in SLOW and MID sample modes.
40 Ω to 4 kΩ ranges . . . . . 5 digits
40 kΩ to 4000 kΩ ranges . . . . . 30 digits
40 MΩ to 400 MΩ ranges . . . . . 10 digits

Temperature coefficient (0°C to 18°C, 28°C to 50°C)
(1/10 of the accuracy for each range)/°C

Maximum input voltage ±500 V DC
Between V/Ω and COM terminals, and between 4 WΩ SENSE H and L terminals

Open circuit test voltage 6.8 V or less

Sample rate Sample rate and noise rejection

Sample rate mode		Reading rate
SLOW		≈4 times/sec
MID		≈20 times/sec
FAST	40 Ω to 4000 kΩ	≈100 times/sec
	40 MΩ, 400 MΩ	≈20 times/sec

Response time

40 Ω to 400 kΩ	50 ms	Zero to full scale within the same range
4000 kΩ	0.1s	
40 MΩ	0.5s	
400 MΩ	5s	

4. DC CURRENT

Accuracy Sample rate : SLOW/MID : ± (% of reading + digits)

Range		23±5°C, 90days	23±5°C, one year	Resolution		Voltage drop across input terminal
				Slow,Mid 5-1/2	Fast 4-1/2	
4 mA		0.05 + 5	0.08 + 7	10 nA	100 nA	≦ 600 mV
40 mA				100 nA	1 µA	
400 mA				1 µA	10 µA	
4000 mA	≦2 A	0.05 + 5	0.08 + 7	10 µA	100 µA	≦ 1 V
	>2 A	0.1 + 5	0.13 + 7			

* In FAST sample mode, add 10 digits to the accuracy in SLOW and MID sample modes.

Temperature coefficient (0°C to 18°C, 28°C to 50°C)
(1/10 of the accuracy for each range)/°C

Maximum current Protected by a 4 A fuse.
4mA to 400 mA range : 4 A DC or rms (5 sec.)
1.5 A DC or rms (continuous)
4000 mA range : 4 A DC or rms (continuous)

Sample rate

Sample rate mode	Reading rate
SLOW	≈4 times/sec
MID	≈20 times/sec
FAST	≈100 times/sec

5. AC CURRENT

Accuracy 23±5°C, one year
Accuracy is specified for 20,000 counts or more: ± (% of reading + digits)

Range	Resolution	Frequency	Accuracy (Sine wave only)	Voltage drop across input terminal
4 mA	10 nA	15 Hz–45 Hz 45 Hz–1 kHz	1.0 + 200 0.4 + 200	≦600 mVrms
40 mA	100 nA			
400 mA	1 µA			
4000 mA	1 µA			≦1 Vrms

* Accuracy is specified at 15 Hz or higher in SLOW and 200 Hz or higher in FAST sample mode.

*** DC component must be smaller than five times of the range.**

Temperature coefficient (0°C to 18°C, 28°C to 50°C)
(1/10 of the accuracy for each range)/°C

AC converter True RMS.

Maximum current Protected by a 4 A fuse.
4 mA to 400 mA range : 4 A DC or rms (5 sec.)
1.5 A DC or rms (continuous)
4000 mA range : 4 A DC or rms (continuous)

Signals other than sine wave : Add the following values to the accuracy of the sine wave

Frequency	Crest factor		
	1–1.5	1.5–2	2–3
15 Hz~1 kHz	0.05%	0.15%	0.3%

Sample rate

Sample rate mode	Reading rate
SLOW	≈4 times/sec
FAST	≈20 times/sec

6. Temperature

Accuracy 23±5°C, one year : ±(% of reading + digits)

Thermocouple type	Temperature range	Resolution	Accuracy
R	0°C – +1600°C	0.1°C	0.2 + 30
K (CA)	–200°C – +1370°C		0.1 + 15
T (CC)	–200°C – +380°C		0.15 + 15
J (IC)	–200°C –+900°C		0.15 + 15
E (CRC)	–200°C – +1000°C		0.15 + 15

* Not includes the accuracy of thermocouple.

Temperature coefficient (0°C to 18°C, 28°C to 50°C)
±0.1°C/°C (for any thermocouples)

Interporation Linear interpolation

Sample rate

Sample rate mode	Reading rate
SLOW	≈4 times/sec
FAST	≈8.3 times/sec

7. FREQUENCY (Hz)

Accuracy Sample rate : 23±5°C one year : ±0.5 (% of reading + digits)

Range	Maximum reading			Resolution(Hz)		
	Slow 5-1/2	Mid 4-1/2	Fast 3-1/2	Slow	Mid	Fast
40 Hz	40.9999	40.999	—	0.1–0.8 m	1–4 m	—
400 Hz	409.999	409.99	409.9	1–8 m	10–40 m	0.1–0.4
4 kHz	4.09999	4.0999	4.099	10–80 m	0.1–0.4	1–4
40 kHz	40.9999	40.999	40.99	0.1–0.8	1–4	10–40
400 kHz	209.999	409.99	409.9	1–8	10–40	100–400

Temperature coefficient (0°C to 18°C, 28°C to 50°C)
(±0.005% of reading)/°C

Measuring method Reciprocal method

Input range ACV 400 mV to 400V range
10 Hz to 100 kHz : 5% to five times of the range
100 kHz to 400 kHz : 30% to three times of the range

Maximum input voltage Up to 200 kHz for input of 200 V to 400 V rms and up to 100 kHz for an input of 400 V rms or more.

Sample rate and gated time

Sample rate mode	Reading rate	Gated time
SLOW	≈1 times/sec	≈1 sec
MID	≈4 times/sec	≈200 msec
FAST	≈20 times/sec	≈20 msec

8. MATH and MISCELLANEOUS FUNCTIONS

8–1. REL and % MATH

① REL math
Y=X-A Y : Reading value
X : Measurement value.
A : Reference value.

② % math
Y = X/A x 100 Y : Reading value.
X : Measurement value.
A : Reference value.

* The function shall be same for all values.
* Full scale is + 999999 under no over-range condition.
* Math ON/OFF and reference value are stored in each function.
* The % indicator lights at % math function.

8-2. MAX/MIN math

Maximum and minimum values are stored in the internal memory in the same function and the same range.
* Data are read out in the RECALL mode.

8-3. AVG math

Moving average of 0 to 100 times (from the keys) or 0 to 255 times (via GP-IB) is available.
Setting the number of average to 0 disables AVG math function with AVG indicator off
* When used in TRIG or remote mode, the AVG math is run once up to the specified number of average.

8-4. STORE function

The internal memory stores up to 3,000 data with the address from 0 to 2999.
* Data are read out in the RECALL mode.

8-5. Continuity test

Continuity test is available by pushing the Ω•))) key at the 2WΩ function.
Threshold level : 17,000 counts ±10,000 counts
Accuracy : Two times of the resistance measurement accuracy.
Sample rate : Approx. 20 times/sec.
* The resistance measurement is available in continuity test.

8-6. A/D converter

Converting method: Triple slope integration.
Integration time
SLOW/MID : 20 m sec (200 m sec) at 50 Hz power line frequency
16.67 m sec (200 m sec) at 60 Hz Power line frequency
The number in the parentheses is at DCV 40 mV range for VOAC 7512 and VOAC 7513.
FAST : 2msec at 50 Hz and 60 Hz power line frequencies. Same specification as SLOW/ MID mode at ACV/ ACA function and 40 MΩ or higher range in 2 WΩ/4 WΩ function.
* Integration time is automatically adjusted depends on the power line frequency, when used with AC power source.
* Manual set of integration time is available, when used with DC power source

8-7. Battery back-up

The last setup before the power off including STORE data is recalled at turning power on when SET UP function is ON..

9. GENERAL

Display : 7-segment LED of 11mm height.
Full scale : 409999 (A/D converter full scale)
999999 (REL math full scale)
Over range display : UUUUUU
Converting method : Drift compensated triple slope integration.
Polarity indication : "—" indication at negative polarity.
Range selection : AUTO/MANUAL or remote control by using option unit.
AUTO ranging : Range up when more than 409999 counts.
Range down when less than 036000 counts.
Function selection : MANUAL or remote control by using option unit.
Withstand voltage : ±500 V DC (between COM input and ground terminals)
Power supply : AC100V ±10% 50/60 Hz or battery operation by using SC-306 option unit.
Option : AC117V, 217V, or 234V
Power consumption : Less than 8W without option unit
Operating temperature : 0°C to 50°C
Operating humidity : Less than 80% RH (0°C to 40°C)
Less than 60% RH (40°C to 50°C)
Warm up time : 1hour after turning power on.
Dimensions : Approx. 191 (W) x 80 (H) x 260 (L) mm
Weight : Approx. 1.9 kg
Accessories : Power code (1), Test lead (1 set). Fuses (4), Alignment screw driver (1), Accessory bag (1), Instruction manual (1)