Model 1281/1271

WAVETEK

Selfcal Digital Multimeters

Model 1281 — versatile precision for Standards Laboratory measurements

- *Configurable for DCV, ACV, DCI, ACI and Ohms measurement*
- *Dual inter-compared 'Selfcal' references for enhanced confidence levels — stability better than 3 ppm/year over a ±5°C temperature range*
- *8½-digit DCV and Ohms, 6½-digit ACV, 100% over-ranging*
- *10 GΩ input impedance (up to 20 V DC) and 10 nV input sensitivity*
- *Special Ohms functions for ultra-high accuracy resistance measurements*
- *Range-to-range and function-to-function ratio measurements*
- *Simultaneous display of voltage and frequency*

Model 1271 — speed and accuracy for Bench and ATE systems

- *Configurable for DCV, ACV, DCI, ACI and Ohms measurement*
- *'Selfcal' for stability over a 0°C to 50°C temperature range*
- *Simultaneous display of voltage and frequency — saving the cost of a separate frequency counter*
- *High-speed AC measurements — 6½ digit readings at 20 readings/second*
- *Special Ohms functions for high accuracy in-circuit measurements*
- *Comprehensive IEEE 488.2 interface*

Accuracy

8½-digit scale length with usable last-digit resolution.

Stable enough to replace standard cells. Much easier to use.

100% over-ranging maintains 10 GΩ input impedance up to 20 V.

Functionality

Simultaneous readout of AC voltage/current and frequency saves the cost of an additional instrument in ATE systems.

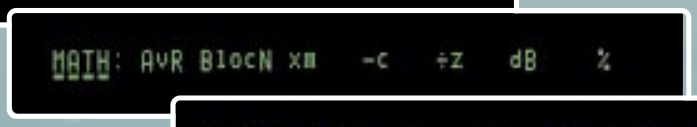
Three separate input channels save the cost of an external scanner and allow function-to-function ratio measurements.

Special Ohms Functions: '2/4-Wire Ohms' eliminates errors due to lead resistance. 'True Ohms' eliminates errors due to thermal emfs. 'LoI Ohms' minimises self-heating in PRTs and allows in-circuit measurements with diode junctions in parallel. 'Ohms Guard' allows in-circuit resistance measurements and guards out leakage paths.

Ease-of-Use

Trade speed for resolution to optimise performance in every application.

Monitor functions give instant access to measurement uncertainties and secondary measurement parameters.



Math functions allow direct display of derived values.

Access secondary functions using no more than two front-panel keystrokes, followed if necessary by simple numeric entry.

Comprehensive self-test ensures maximum operability.

Model 1281 — Working for Cal Lab Efficiency

While continuously striving to reduce measurement uncertainties, calibration laboratories are also under commercial pressure to reduce costs. Calibration equipment needs to be chosen not only for the uncertainty levels it can deliver, but also the range of uses to which it can be put. For accuracy coupled with versatility, no other standards laboratory DMM matches the superb performance of Wavetek's Model 1281.

The Model 1281 Can Replace:-

- *Standard 'Weston' Cells*
- *Null Detectors and µV Meters*
- *Kelvin Varley Dividers*
- *Thermal Transfer Standards*
- *Resistance Bridges*

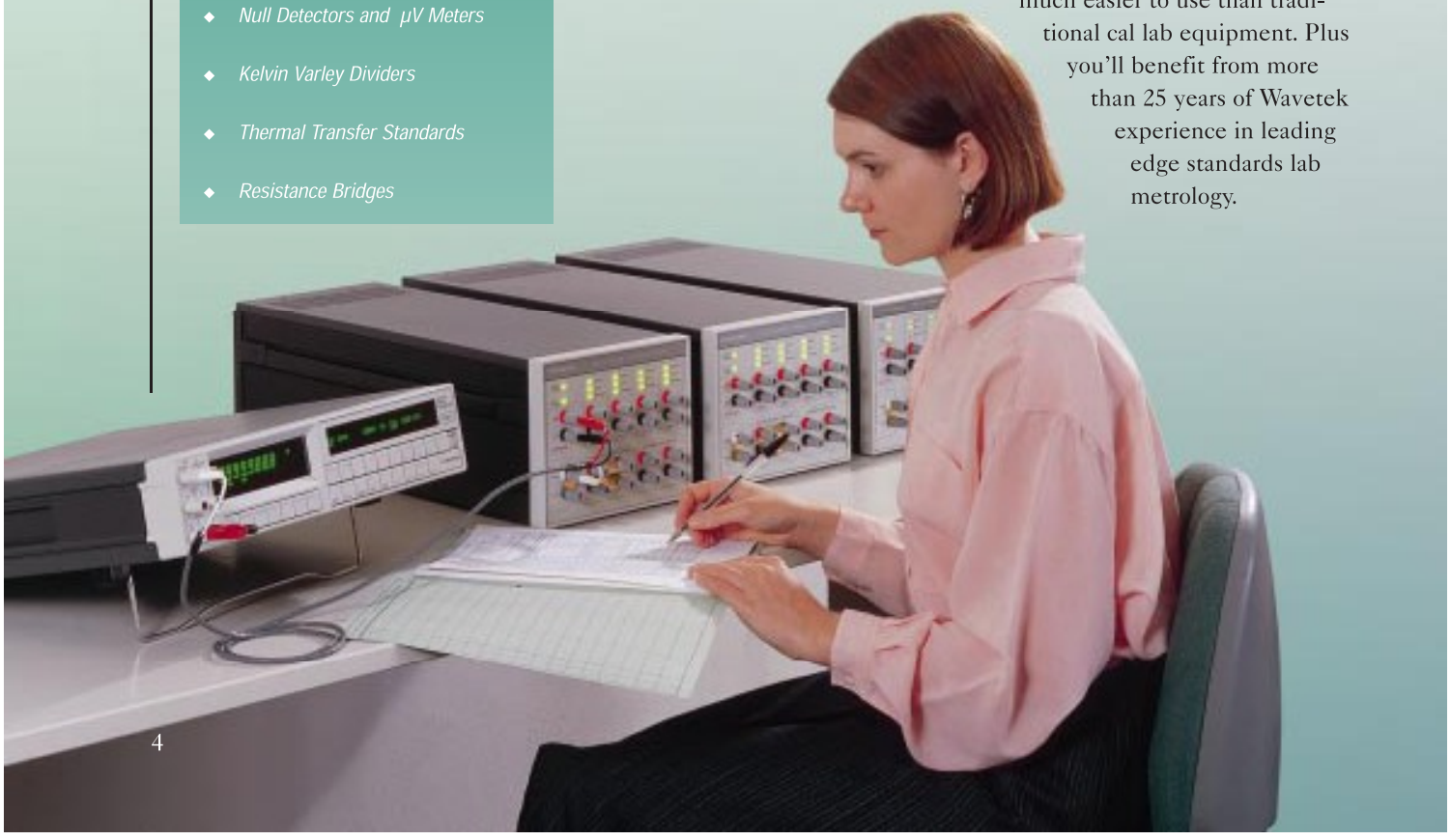
At the heart of the Model 1281, two specially conditioned 10-volt zener references are continuously inter-compared to minimize drift rate. Coupled with the DC input amplifier's incredibly low 0.25 µV/°C temperature coefficient, this allows the Model 1281 to achieve a 10-volt range stability over a 1 year period and ±5°C temperature range of 3ppm. That's as good as many Weston cells. And because the Model 1281's temperature coefficient is far superior to a Weston cell's, you don't have to worry about precision temperature control.

Add the fact that it offers exceptional 0.1 ppm (± 2 µV) single-range linearity from zero to 20 V, and you realise that the Model 1281 not only substitutes for Weston cells. It also doubles up as a highly sensitive null detector (with an input impedance >10 GΩ) and a Kelvin Varley divider.

The Model 1281 also features exceptional AC performance, with 1-year uncertainties significantly below 100 ppm up to 10 kHz on its 1 V to 100 V ranges. Its 'spot calibrated frequency' feature gives you even greater precision. Coupled with unique AC/DC transfer capabilities, this allows the Model 1281 to replace a conventional thermal transfer standard.

The Model 1281 also has unique Ohms measurement features. Its active 'Ohms Guard' terminal lets you guard out leakage current paths when measuring very high value resistors. And its 'LoI' mode prevent excessive self-heating in PRTs. The Model 1281's 2-input ratio function allows you to use it as a high performance automated bridge.

When you purchase the Model 1281 you're not only buying a multifunction DMM. You're also buying a multi-purpose instrument that's much easier to use than traditional cal lab equipment. Plus you'll benefit from more than 25 years of Wavetek experience in leading edge standards lab metrology.



Model 1271 — The Best in Precision ATE Performance

The Model 1271 is a true systems multimeter, capable of taking 1000 readings per second, operating over a wide ambient temperature range, and making in-circuit measurements. Yet it's more than accurate enough to satisfy the most demanding ATE requirements.

In addition to superb DC voltage capabilities, the Model 1271 features AC performance that is unsurpassed by any other systems DMM. Above 1kHz, it can take up to 20 high-accuracy 6½-digit AC readings per second. And simultaneous measurement of the input signal frequency saves the cost of a separate frequency counter.

ATE systems often cause problems for high-accuracy DMMs because of the large temperature rise that can occur in equipment racks. Not so for the Model 1271.

Using its Selfcal feature, you can maintain full measurement accuracy at temperatures as high as 35°C, without losing traceability. And you only need to perform Selfcal every 30 days or when the ambient temperature shifts more than 5°C. Compare that to other precision systems DMMs that require an internal cal every 24 hours to maintain full specification.

The Model 1271 also excels at in-circuit testing. Its special Ohms functions allow accurate measurement of resistors even when they are part of complex resistor networks or when they have diode junctions in parallel. Its True-Ohms function eliminates thermal emfs and similar offset voltages in signal multiplexers. The availability of three separate input channels means that in many applications you won't even need to use an external signal multiplexer.

The Model 1271 is also built for safety. Two rear-panel mounted input channels keep signal cabling safely in the back of the cabinet, leaving the front-panel terminals free for manual testing or system debugging.

The Model 1271 – True Systems Capabilities

- *1000 Fully Formatted 5-½ Digit DC Readings/Second into Internal Memory*
- *20 High-Accuracy AC Readings/Second above 1 kHz*
- *Extended Volt.Hz Envelope for High Voltage, High Frequency Signals*
- *High Accuracy In-Circuit Ohms Measurements*
- *Fully Traceable Measurement Over a Wide Operating Temperature Range*

Model 1281/1271

Model 1281 Uncertainty Specifications

Function	Range [1]	Frequency (Hz) or Mode	Uncertainty Relative to Calibration Standards ±(ppmR + ppmFS) [2][3][4]		Typical Calibration Uncertainty (ppm)	Temperature Coefficient 13°C - 18°C 28°C - 33°C after Selfcal [5] (ppm/°C)
			24 Hour 23°C ± 1°C	1 Year 23°C ± 1°C or 23°C ± 5°C after Selfcal [5]		
DC Voltage	100.000 00mV		1.0 + 0.5	6 + 0.5	6.5	0.3
	1.000 000 00V		0.5 + 0.2	3 + 0.2	3.5	0.25
	10.000 000 0V		0.5 + 0.1	3 + 0.1	2.5	0.25
	100.000 000V		1.0 + 0.2	6 + 0.2	3.5	0.4
	1000.000 00V		1.0 + 0.2	6 + 0.2	3.5	0.4
AC Voltage [7][8]	100.000 0mV	40 - 10k	60 + 20	100 + 20	155	5
		10k - 30k	250 + 30	300 + 40	220	10
		30k - 100k	400 + 100	700 + 100	430	40
	1.000 000V to 100.000 0V [9]	40 - 100	50 + 10	80 + 10	75	5
		100 - 2k	30 + 10	60 + 10	35	5
		2k - 10k	50 + 10	80 + 10	35	5
		10k - 30k	100 + 20	200 + 20	50	10
		30k - 100k	250 + 100	500 + 100	70	40
		100k - 300k	0.15% + 0.1%	0.3% + 0.1%	180	40
		300k - 1M	1% + 0.5%	1% + 1%	1400	40
	1000.000V [9][10]	40 - 10k	50 + 10	80 + 10	75	10
		10k - 30k	100 + 20	200 + 20	250	10
		30k - 100K	250 + 100	500 + 100	700	40
Spot Frequency AC Voltage [11][12]	100.000 0mV	40 - 10k	40 + 10	100 + 10	155	5
		10k - 30k	60 + 25	150 + 25	220	10
		30k - 100k	100 + 100	500 + 100	430	20
	1.000 000V to 100.000 0V [9]	40 - 10k	30 + 5	60 + 5	75	5
		10k - 30k	50 + 15	150 + 15	50	10
		30k - 100k	100 + 50	400 + 50	70	40
		100k - 300k	0.1% + 0.05%	0.2% + 0.05%	180	40
		300k - 1M	0.2% + 0.3%	0.5% + 0.3%	1400	40
	1000.000V [9][10]	40 - 10k	30 + 5	60 + 5	75	10
		10k - 30k	50 + 15	150 + 15	250	10
		30k - 100K	100 + 50	400 + 50	700	40
Resistance [13]	10.000 000Ω [14]	Normal Mode 10mA	3.0 + 1.0	12 + 1.0	15	0.8
	100.000 000Ω	Normal Mode 10mA	1.5 + 0.3	8 + 0.3	7.5	0.5
	1.000 000 00kΩ	Normal Mode 1mA	1.0 + 0.3	6 + 0.3	6	0.5
	10.000 000 0kΩ	Normal Mode 100µA	1.0 + 0.3	6 + 0.3	5.5	0.5
	100.000 000kΩ	Normal Mode 100µA	1.0 + 0.3	6 + 0.3	10	0.8
	1.000 000 00MΩ	Normal Mode 10µA	2.0 + 0.7	10 + 0.7	20	1.0
	10.000 000 0MΩ	Normal Mode 1µA	4.0 + 4.0	20 + 4.0	30	1.5
	100.000 0MΩ	Normal Mode 100nA	30 + 45	200 + 45	140	15
	1.000 000GΩ	Normal Mode 10nA	300 + 450	0.2% + 0.045%	350	150
	10.000 000Ω [14]	Lo I Mode 10mA	3 + 1	12 + 1	15	0.8
	100.000 000Ω	Lo I Mode 1mA	5 + 1	12 + 1	7.5	0.8
	1.000 000 00kΩ	Lo I Mode 100µA	5 + 1	12 + 1	6	0.8
	10.000 000 0kΩ	Lo I Mode 10µA	5 + 1	15 + 1	5.5	1.0
	100.000 000kΩ	Lo I Mode 1µA	50 + 3	70 + 3	10	2.0
	1.000 000 00MΩ	Lo I Mode 100nA	200 + 10	400 + 10	20	15
DC Current	100.000 0µA		20 + 2	25 + 2	35	8
	1.000 000mA		20 + 2	25 + 2	20	8
	10.000 00mA		20 + 2	25 + 2	20	8
	100.000 0mA		30 + 5	50 + 5	25	8
	1.000 000A		100 + 10	150 + 10	40	10
AC Current [7]	100.000µA	10 - 5k	150 + 50	200 + 100	200	15
	1.000 00mA to 100.000mA	10 - 5k	150 + 50	200 + 100	200	15
	1.000 00A	10 - 1k	400 + 100	500 + 200	200	15
		1k - 5k	0.1% + 0.03%	0.15% + 0.04%	350	15

	Model 1281	Model 1271
DC Voltage		
Type	Multi-slope, multi-cycle A-D converter	
CMRR (1kΩ unbalance)	140dB at DC >80dB + NMRR at 1 to 60Hz	
NMRR		
filter out	60dB at 50/60Hz ± 0.09%	60dB at 50/60Hz
filter in	110dB at 50/60Hz	100dB at 50Hz + 12dB/oct
Protection (all ranges)	1kV rms	
Input impedance		
0.1V to 10V ranges	> 10.000MΩ	
100V & 1kV ranges	10MΩ ± 0.1%	
Max input Current	50pA	
Ratio Accuracy	±(Net ChA Accuracy + Net ChB Accuracy)	
Settling Time (to 10ppm step size)		
filter out	<50ms	<500µs
filter in	<1s	<500ms
AC Voltage		
Type	True RMS. AC coupled measures AC component with up to 1000V DC bias on any range. DC coupled gives √(AC²+DC²)	
CMRR (1kΩ unbalance)	>90dB DC to 60Hz	
Crest Factor	5:1 at Full Range (10:1 at 25% of range)	
Protection (all ranges)	1kV rms	
Input Impedance	1MΩ in parallel with 150pF	
LF Accuracy (DC coupled)		
DC	Add ±(50ppmR + 20ppmFS + 20µV)	
1Hz - 10Hz	Add ±(20ppmR + 50ppmFS)	
10Hz - 40Hz	Add ±20ppmR	
Ratio Accuracy	±(Net ChA Accuracy + Net ChB Accuracy)	
Settling Time (to 100ppm step size)		
1kHz	–	<30ms (option 10 only)
360Hz	–	<100ms (option 10 only)
100Hz	<0.5s	–
40Hz	<1.25s	<1s
10Hz	<5s	<5s
1Hz	<50s	–
Frequency		
Range	10Hz to 1MHz, from 5% of range to limits set by Max Volt.Hertz	
Resolution	4.5 digits or 6.5 digits	
Accuracy (1 Year, 13°C - 33°C, typical)	±(10ppmR + 2 digits)	±(10ppmR + 0.5ppmFS + 1digit)
Sample Interval		
Fast Gate	50ms (4.5 digits, 200Hz to 1MHz)	
Normal Gate	1s (6.5 digits, 10Hz to 1MHz)	

	Model 1281	Model 1271
Resistance		
Type	True 4-wire with Ohms guard. 2-wire selectable	
Max Lead Resistance	100Ω in any or all leads	
Protection (all ranges)	250Vrms	
Ratio Accuracy	± (Net ChA Accuracy + Net ChB Accuracy)	
Settling Time	Up to 100kΩ range generally the same as DC Voltage but depends on external connections	
DC Current		
Type	Multi-slope, multi-cycle A-D converter.	
Protection	<2A, internally clamped >2A, rear panel fuse	
Ratio Accuracy	±(Net ChA Accuracy + Net ChB Accuracy)	
Settling Time	As DCV	
AC Current		
Type	True RMS AC coupled. DC coupled gives √(AC² + DC²)	
Crest Factor	3:1 at Full Range	
Protection	<2A, internally clamped >2A, rear panel fuse	
Ratio Accuracy	±(Net ChA Accuracy + Net ChB Accuracy)	
Settling Time	As AC Voltage	
Environment		
Temperature		
Operating	0°C to +50°C	
Storage	-40°C to +70°C	
Relative Humidity (non condensing)		
0°C to 30°C	< 95%	
30°C to 40°C	< 75%	
40°C to 50°C	< 45%	
Warm-up	4 hours to full uncertainty specification	
Power		
Voltage	100V to 130V or 200V to 260V	
Frequency	47Hz to 63Hz	
Consumption	37VA	
Dimensions		
Height	88mm (3.5 inches)	
Width	427mm (16.8 inches)	
Depth	487mm (19.2 inches)	
Weight	13.5kg (30 lbs)	
Safety	Designed to UL1244, IEC348 and BS4743	
EMC (incl. options)	CE Marked	
Warranty	1 year	

Model 1271 Uncertainty Specifications

Function	Range [1]	Frequency (Hz) or Mode	Uncertainty Relative to Calibration Standards ±(ppmR + ppmFS) [2][3][4]		Typical Calibration Uncertainty (ppm)	Temperature Coefficient (ppm/°C) [6]
			24 Hour 23°C ± 1°C	1 Year [6]		
DC Voltage	100.000 00mV		3 + 1	10 + 1	6.5	0.3
	1.000 000 00V		2 + 0.5	8 + 0.5	3.5	0.25
	10.000 000 0V		2 + 0.25	7 + 0.25	2.5	0.25
	100.000 000V		3 + 0.5	8 + 0.5	3.5	0.4
	1000.000 00V		3 + 1	10 + 1	3.5	0.4
AC Voltage [7]	100.000 0mV	40 - 2k	150 + 70	250 + 70	155	10
		2k - 20k	300 + 120	400 + 120	220	20
		20k - 100k	800 + 220	0.16% + 0.022%	430	60
	1.000 000V to 100.000 0V	40 - 20k	100 + 50	200 + 50	75	20
		20k - 100k	400 + 200	0.1% + 0.02%	70	60
		100k - 300k	0.5% + 0.5%	1% + 1%	180	60
		300k - 1M	1.5% +1%	2% + 2%	1400	60
	1000.000V [9][10]	40 - 2k	150 + 70	250 + 70	75	10
		2k - 20k	300 + 120	400 + 120	250	20
		20k - 100K	800 + 220	0.16% + 0.022%	700	60
Resistance [13]	10.000 000Ω [14]	Normal Mode 10mA	6 + 2	18 + 2	15	4
	100.000 000Ω	Normal Mode 10mA	3 + 0.5	10 + 0.5	7.5	2
	1.000 000 00kΩ	Normal Mode 1mA	3 + 0.5	10 + 0.5	6	2
	10.000 000 0kΩ	Normal Mode 100µA	3 + 0.5	10 + 0.5	5.5	2
	100.000 000kΩ	Normal Mode 100µA	3 + 0.5	10 + 0.5	10	2
	1.000 000 00MΩ	Normal Mode 10µA	6 + 1	15 + 1	20	2
	10.000 000 0MΩ	Normal Mode 1µA	12 + 5	30 + 5	30	4
	100.000 0MΩ	Normal Mode 100nA	50 + 50	400 + 50	140	40
	1.000 000GΩ	Normal Mode 10nA	500 + 500	0.3% + 0.05%	350	300
	10.000 000Ω [14]	Lo I Mode 10mA	6 + 2	18 + 2	15	4
	100.000 000Ω	Lo I Mode 1mA	10 + 2	17 + 2	7.5	4
	1.000 000 00kΩ	Lo I Mode 100µA	10 + 2	17 + 2	6	4
	10.000 000 0kΩ	Lo I Mode 10µA	10 + 2	20 + 2	5.5	4
	100.000 000kΩ	Lo I Mode 1µA	150 + 5	180 + 5	10	5
	1.000 000 00MΩ	Lo I Mode 100nA	400 + 15	600 + 15	20	400
DC Current	100.000 0µA		20 + 2	50 + 2	35	8
	1.000 000mA		20 + 2	50 + 2	20	8
	10.000 00mA		20 + 2	50 + 2	20	8
	100.000 0mA		30 + 5	100 + 5	25	8
	1.000 000A		100 + 10	150 + 10	40	10
AC Current [7]	100.000 0µA	10 - 5k	150 + 50	200 + 100	200	15
	1.000 00mA to 100.000mA	10 - 5k	150 + 50	200 + 100	200	15
	1.000 00A	10 - 1k	400 + 100	500 + 200	200	15
		1k - 5k	0.1% + 0.03%	0.15% + 0.04%	350	15

Notes for 1281 and 1271 Specification Tables :

[1] 100% over-range on all ranges (except 1kV DC & AC).
[2] Combined uncertainties to 95% minimum confidence level for max resolution in each function, normal read mode.
[3] Assumes 4-hour warm-up period.
[4] FS = 2 x Full Range.
[5] Selfcal required whenever the temperature moves more than ±1°C from the temperature at which the previous Selfcal was performed.
[6] Valid for 30 days after Selfcal, ±1°C of Selfcal temperature and within ±15°C (DCV and ACV) or ±5°C (other functions) of Autocal calibration temperature. Assumes Autocal at 23°C ± 5°C.
[7] Valid for signals >1% FS.
[8] Assumes Transfer Mode is active.
[9] Max Volt.Hertz 3 x 10^7.
[10] >300V add ±0.0024 $(R-300)^2$ppmR.
[11] Valid within ±10% of calibrated RMS value and Spot Frequency.
[12] Instrument includes six 'Spot Frequencies' per range that are normally shipped uncalibrated. Contact factory for Spot Frequency calibration prices.
[13] True Ohms mode available on 10Ω to 100kΩ ranges.
[14] 10Ω range available only in True Ohms mode.
[15] Calibrated at 23°C. Includes calibration uncertainty.

Read Rate and Additional Uncertainty Specifications

Function	Resolution	Model 1281 Frequency (Hz)	Model 1281 Read Rate (readings/second) Normal	Model 1281 Read Rate (readings/second) Fast	Model 1281 Additional Errors ±(ppmR + ppmFS) Normal	Model 1281 Additional Errors ±(ppmR + ppmFS) Fast	Model 1271 Frequency (Hz)	Model 1271 Read Rate (readings/second) Normal	Model 1271 Read Rate (readings/second) Fast	Model 1271 Additional Errors ±(ppmR + ppmFS) Normal	Model 1271 Additional Errors ±(ppmR + ppmFS) Fast
DCV, DCI & Ohms	8	-	1/25	1/6	0 + 0	0 + 0.1	-	1/10	1/6	0 + 0	0 + 0
	7	-	1/6	1/2	0 + 0.1	0 + 0.4	-	1/2	3	0 + 0	0 + 0
	6	-	2	35	0 + 0.5	0 + 3	-	10	50	0 + 0.5	0 + 3
	5	-	35	150	0 + 5	0 + 30	-	50	1000	0 + 5	0 + 30
	4	-	35	150	0 + 50	0 + 50	-	-	-	-	-
			Transfer Off	**Transfer On**	**Transfer Off**	**Transfer On**					
ACV & ACI	6	1	1/25	1/50	200 + 20	0 + 0	10	1/5		0 + 0	
		10	1/2.5	1/5	200 + 20	0 + 0	40	1		0 + 0	
		40	1	1/2	200 + 20	0 + 0	360	8		0 + 0	
		100	3	1	200 + 20	0 + 0	1k	20		0 + 0	
	5	1	1/25	1/50	200 + 20	0 + 5	10	1/5		0 + 0	
		10	1/2.5	1/5	200 + 20	0 + 5	40	1		0 + 0	
		40	1	1/2	200 + 20	0 + 5	360	8		0 + 0	
		100	4	2	200 + 20	0 + 5	1k	20		0 + 0	
	4	1	1/25	1/50	200 + 20	0 + 50	-	-		-	
		10	1/2.5	1/5	200 + 20	0 + 50	-	-		-	
		40	1	1/2	200 + 20	0 + 50	-	-		-	
		100	4	2	200 + 20	0 + 50	-	-		-	

Model 4953 Current Shunt Uncertainty Specifications

Function	Range	Frequency (Hz)	Resistance (Ohms)	Power Rating (Watts)	Accuracy (%) [15]
DC Current	11A max.	-	0.01	1.2	0.009
AC Current	11A max.	40	0.01	1.2	0.05
		300	0.01	1.2	0.05
		1k	0.01	1.2	0.05
		10k	0.01	1.2	0.12

Ordering Information

Model 1281

Model 1281	8-1/2 Digit Selfcal Digital Multimeter (includes DCV, Ratio, Rear Inputs and IEEE-488.2 Interface)
Option 10	True RMS AC Converter
Option 20	2 wire and 4 wire Resistance Converter
Option 30*	Current Converter (only available with Option 20)
Option 50	10A Shunt
Option 70	Isolated Analog Output
Option 80	115V, 60Hz Line Operation
Option 90	Rack Mounting Kit

** Requires Option 10 for AC Current Measurements*

Model 1271

Model 1271	8-1/2 digit Selfcal Digital Multimeter (Includes DCV, Rear Input and IEEE-488.2 Interface)
Option 10	True RMS High Speed AC Converter
Option 20	2 wire and 4 wire Resistance Converter
Option 30*	Current Converter (only available with Option 20)
Option 40	Comprehensive Ratio
Option 50	10A Shunt
Option 70	Isolated Analog Output
Option 80	115V, 60Hz Line Operation
Option 81	115V, 50Hz Line Operation
Option 90	Rack Mounting Kit

Other Precision Instruments from Wavetek

4800-Series DMM Calibrators

DC & AC Voltage, DC & AC Current and Ohms. Calibration of DMMs to 8-½ digits. Two levels of precision.

Model 9500 Oscilloscope Calibrator

High accuracy calibration of analog and digital-storage oscilloscopes up to 1 GHz.

Model 9100 Multi-Product Calibrator

Calibration of over 14 different categories of general-purpose test and measurement equipment.

Model 1361 Precision VXIbus Digital Multimeter

DC & AC Voltage to 1000V plus Ohms. 4-½ to 6-½ digit resolution. 1000 readings/s.

Model 1362S Precision VXIbus Digital Multimeter

DC & AC Voltage to 300V plus Ohms. 4-½ to 6-½ digit resolution. 1000 readings/s.

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