HIGH PERFORMANCE DMMS 7081 & 7071

■ **Resolution 1 in 140 million**

■ **Cut the cost of ownership**

■ **The lowest-cost transportable standards room**

■ **No need for frequent re-calibration**

DC Voltage 10nV to 1kV
Resolving one point in 140 million and 14 million respectively, the 7081 and 7071 use pulse-width conversion for unparalleled accuracy and linearity.

AC Voltage 1μV to 750V
True rms ac measurement from dc to 1MHz. A patented technique is used to remove the need for matching log-antilog transistors, improve long term stability and provide excellent ac performance from 1.5Hz to 1MHz with 1μV sensitivity. This conversion technique is faster than thermal rms convertors, more accurate over a wide dynamic range and can also measure ac + dc.

Resistance 10μΩ to >1400MΩ
4-terminal fully floating measurement to 1000kΩ. Two additional 2-wire conductance ranges extend measurement to greater than 1400MΩ.

Using Solartron's "True Ohm" function, thermal emf is eliminated by automatically measuring the voltage without excitation current and subtracting this from the normal resistance measurement.

Temperature
The 7081 and 7071 are the ultimate temperature standards with unmatched precision resistance measurement. Using a PRT (RTD), better than one millidegree resolution is provided with comparable accuracy. With one milliamp measuring current, dissipation is only 100μW. These features mean you get performance exceeding that of resistance bridges. "True ohms" mode further improves the accuracy by eliminating thermal emf errors.

Current
For the best ac and dc current measurement the shunt resistor used must be suited to the level being measured. Use the 7081 or 7071 to measure the resistor of your choice and insert it in the circuit. You can then use the ratio program to divide the measured voltage by resistance for a result in mA. Low voltage burden and high sensitivity ensure accurate high current measurement. A very low leakage input amplifier enables superb low current measurement accuracy.

Ratio
Eight different ratio measurements are available. Ratio to an reference input of up to ±14V dc or to a numerical constant. The latter may be a measurement result accessed from the voltmeter memory. The ratios are presented as linear or logarithmic (dB).

Digital Calibration
Calibration via the IEEE488 or RS232 interface. See the description on page A3.

History file
Memory can retain and recall the most recent 500 results in full format (including time and date) or 1500 in a compressed (numeric value only) format. The file can be recalled and displayed either from the front panel or via the systems interface.

Filter
Pulse-width conversion combined with digital filtering provides excellent noise rejection without the need for analog filters. Problems associated with analog filters include long settling time and dielectric absorbtion which causes new measurements to be biased by old ones. Three digital filter types are offered:

Continuous average: the average of all measurements, updated by each new measurement.

Simple average: the average of a user specified number of measurements.

Walking window average: specify a sample window size N. The result is always the average of the last N measurements.

Processing

The 7081 contains powerful software enabling built-in programs to convert raw measurements into more useful results. Programs include:

- Average
- Variance
- Standard Deviation
- Root Mean Square
- Scaling
- Peak to Peak
- Limits
- Linear Ratio
- Log Ratio (dB)
- Offset

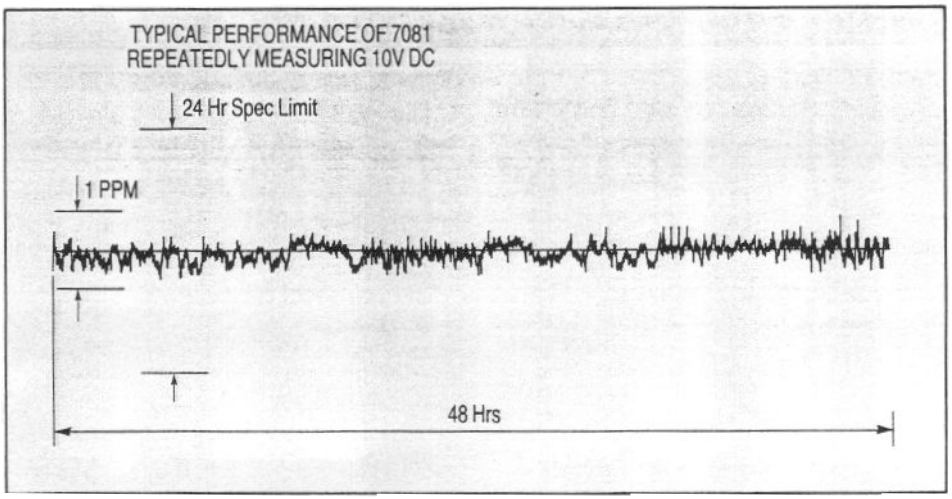
A feature of the processing program is that while one result is being output, others are retained for subsequent recall. Furthermore, the programs may be strung together so that the result from one enters the next. Hence a ratio measurement, for example, could be averaged, scaled and compared with limits.

Time control

A real-time clock and calendar with a 10-year battery provides real and elapsed time control of measurements. Just specify begin time, interval and end time to accomplish automatic measurements by day or night, or over weekends. The results will be stored in the 1500 reading history file or output directly to a controller or a printer.

Systems Interface

The IEEE488 and RS232 interfaces are included as standard with full Talk/Listen and Talk Only operation. Commands are in easily understood ENGLISH format but may be abbreviated to reduce message size. Communication with all popular controllers is fast to set up and easy to implement.



ROOT YEAR RELATIONSHIP

Realistic specifications should not be based on speculation. They require a real knowledge of components, their behaviour under stress, and their drift with time.

Long-term assessment of precision components has enabled Solartron to specify performance from 90 days to 9 years using a simple square-root-year relationship for calibration drift with time. Tests conducted over several years using precision resistors and zeners from many leading manufacturers indicate that drift reduces with time and the change is porportional to the square root of time. Using pre-aged, hermetically encapsulated components, the drift is reduced to extremely low levels, and can be predicted accurately for short or long periods. Accuracy specified for one year can be used with a multiplier to provide all additional information as shown below:

Required Spec Time	One year Multiplier
3 month	0.5
6 month	0.7
1 year	1.0
2 year	1.4
4 year	2.0
9 year	3.0

CALIBRATED FOR LIFE

Beyond 9 years the drift becomes insignificant such that 3 times the one year figure will predict the performance for the life of the voltmeter – however long that may be. Traceability to International Standards can be maintained for long periods.

The square-root-year relationship applies to both 7071 and 7081. Both will retain their predicted long term specification even if subjected to rigorous working conditions. However, the best stability and minimum long term drift will be obtained by maintaining the instrument in a reasonable environment. The user should consider leaving these precision voltmeters switched on and avoid extreme environmental conditions. In these circumstances the long term performance can be expected to be even better than that which is predicted.

Calibration for Life, now introduced for the first time by Solartron, gives important savings in time and money, thus making a significant reduction in cost of ownership.

ACCURACY

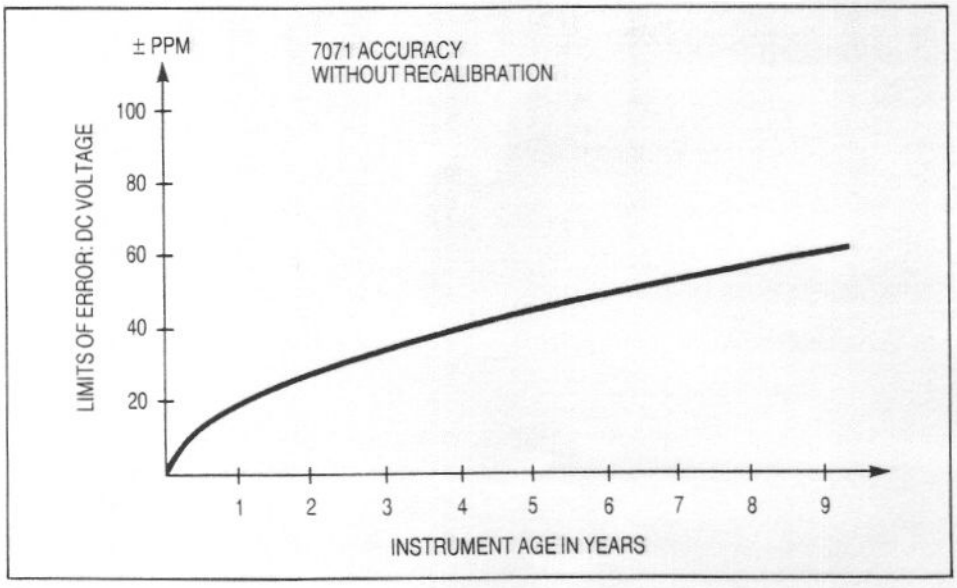
The following apply to the Accuracy sections:
Limits of Error: apply after 24 hours warm-up*
ac inputs >2% of range
dc and resistance with null in use

* Instruments are usable within minutes after switch-on but for ultimate precision a long warm-up is recommended in a stable thermal environment.

Temperature coefficient: expressed as ±ppm rdg/°C valid from 10 to 30°C

Temperature coefficient need be applied only outside the temperature span quoted with T_c.

Calibration Temperature (T_c) is the temperature of the calibration room environment. Calibration occurs at 20°C (23°C for USA) and is directly traceable to International Standards via the National Physical Laboratory or the National Bureau of Standards. Recalibration is valid at T_c from 18°C to 25°C.



7071 DC VOLTAGE Scale length 14 000 000 Predicted limits of error for life: 60ppm rdg + 1ppm fs

STABILITY 24hrs, 7½ digits
± [ppm rdg + ppm fs] T_c ± 1°C

Range	Sensitivity	Guaranteed	Transfer
0.1V	10nV	3.0 + 1.0	0 + 1.0
1V	100nV		
10V	1μV		
100V	10μV		
1000V	100μV		

Input Resistance: 0.1, 1, 10V range: >10GΩ
100, 1000V range: 10MΩ ± 0.1%
Input Current, at T_c °C: <20pA

LIMITS OF ERROR per square-root-year
± [ppm rdg + ppm fs] T_c ± 5°C

Range	Guaranteed	Typical	Temp. Coeff
0.1V	20 + 1	14 + 0.8	2.0
1V			
10V			
100V			
1000V			

Range of Null: ±10% of range
Sample settling time: 13ms × (digits selected)

INTEGRATION TIME, TRACKING SPEED

Digits	Integration	Speed	Add Error
7½	3.2s	1/3.2s	– –
6½	0.4s	2.5/s	±1 digit
5½	0.1s	10/s	±1 digit
4½	6.25ms	85/s	±1 digit
3½	1.56ms	100/s	±1 digit

Overload Protection
Autorange: 1kV pk
Commanded range: 0.1, 1, 10V: 350V pk
100, 1000V: 1kV pk

7071 AC VOLTAGE True rms of ac or ac+dc Scale length 1 400 000

STABILITY
24hrs, T_c ± 1°C, ± [% reading + % full scale]

Range	Sensitivity	10 to 40Hz	40Hz to 10kHz	10k to 100kHz
0.1V	1μV	0.05 + 0.006	0.005 + 0.005	0.02 + 0.03
1V	1μV	0.05 + 0.006	0.005 + 0.005	0.02 + 0.03
10V	10μV	0.05 + 0.006	0.015 + 0.005	0.05 + 0.03
100V	100μV	0.06 + 0.006	0.02 + 0.005	0.2 + 0.03
1000V	1mV	0.08 + 0.01	0.035 + 0.007	

LIMITS OF ERROR
Error per square-root-year, T_c ± 5°C, ± [% reading + % full scale]

Range	10 to 40Hz	40Hz to 10kHz	10k to 100kHz	100k to 1MHz
0.1V	0.06 + 0.005	0.02 + 0.005	0.04 + 0.04	1 + 1
1V	0.06 + 0.005	0.02 + 0.005	0.04 + 0.04	1 + 1
10V	0.06 + 0.005	0.03 + 0.005	0.07 + 0.04	1 + 1
100V	0.07 + 0.005	0.04 + 0.005	0.22 + 0.04	– –
1000V	0.09 + 0.01	0.05 + 0.007	– –	– –

INTEGRATION TIME, TRACKING SPEED

Digits	Display	Integ	Speed	Add Error
7½	6½	3.2s	1/3.2	– –
6½	5½	0.4s	2.5/s	
5½	4½	0.1s	10/s	±1 digit
4½	3½	6.25ms	85/s	±1 digit
3½	3½	1.56ms	100/s	±2 digits

Low Frequency Error

below 1kHz	use ~ Filt.
5 to 10Hz	add 0.25% rdg
3 to 5Hz	add 0.3% rdg
2 to 3Hz	add 0.6% rdg
1.5 to 2Hz	add 1.0% rdg
DC	add 0.1% rdg

Input Impedance: 1MΩ||150 pF
Temp. Coeff, up to 10kHz: ±30 ppm rdg/°C

Sample settling time: 20ms × (digits selected)
~ Filter selected: 400ms × (digits selected)

Maximum Inputs
Autorange: 1kV pk
Commanded range: 0.1, 1V: 350V pk
10, 100, 1000V: 1kV pk
Maximum V × Hz: 10^7
Crest Factor at fs: 5:1

7071 RESISTANCE Scale length 14 000 000 Predicted limits of error for life: 3 × guaranteed limits

STABILITY 24hrs, 7½ digits
± [ppm rdg + ppm fs] T_c ± 1°C

Range	Sensitivity	Guaranteed	Transfer
0.1kΩ	10μΩ	3 + 1	0 + 1
1kΩ	100μΩ	3 + 1	0 + 1
10kΩ	1mΩ	3 + 1	0 + 1
100kΩ	10mΩ	3 + 1	0 + 1
1000kΩ	100mΩ	4 + 1	0 + 1
10MΩ	1Ω	10 + 1	0 + 1
1000MΩ	10ppm rdg	1ppm/MΩ	– –

Measurement: 4-wire, 0.1kΩ to 1000kΩ ranges
2-wire, 10MΩ and 1000MΩ range
Current source: 0.1, 1, 10kΩ 1mA
100kΩ, 1000kΩ 10μA
10MΩ, 1000MΩ 1μA max

LIMITS OF ERROR per square-root-year
± [ppm rdg + ppm fs] T_c ± 5°C

Range	Guaranteed	Temp. Coeff
0.1kΩ	20 + 1	2
1kΩ	20 + 1	2
10kΩ	20 + 1	2
100kΩ	20 + 1	2
1000kΩ	20 + 1	2
10MΩ	60 + 1	5
1000MΩ	10ppm/MΩ	1ppm/MΩ

Maximum total lead resistance: 1kΩ
Sample settling time: 13ms × (digits selected)
Add 10ms/MΩ

INTEGRATION TIME, TRACKING SPEED

Digits	Integration	Speed	Add Error
7½	3.2s	1/3.2s	– –
6½	0.4s	2.5/s	±1 digit
5½	0.1s	10/s	±1 digit
4½	6.25ms	85/s	±1 digit
3½	1.56ms	100/s	±1 digit

Overload protection: 350V pk
Open circuit voltage: 17V dc
Range of Null: ±10% of range

7081 AND 7071

GENERAL

Power Supply
Voltage: 110/120/220/240V +15% −10%
Frequency, automatic sensing: 48 to 52Hz, 57 to 63Hz, 384 to 416Hz
Consumption: 40VA

Safety
Designed in accordance with IEC 348, BS4743 and UL1244

Environment
Operating: 0°C to +45°C
Storage: −20°C to +70°C
Relative Humidity: 90% at 40°C (non condensing)

Dimensions
Height: 88mm (3.5ins)
Width: 432mm (17ins)
Depth: 419mm (16.5ins)
Weight: 8.25kg (19lbs)

7081 DC VOLTAGE Scale length 140 000 000

STABILITY 24hrs, 8½ digits
± [ppm rdg + ppm fs] T_c ± 1°C

Range	Sensitivity	Guaranteed	Transfer
0.1V	10nV	2.0 + 0.8	0 + 0.8
1V	10nV	2.0 + 0.4	0 + 0.4
10V	100nV	1.2 + 0.3	0 + 0.3
100V	1μV	2.0 + 0.4	0 + 0.4
1000V	10μV	3.0 + 0.3	0 + 0.3

Input Resistance: 0.1, 1, 10V range: >10GΩ
100, 1000V range: 10MΩ ± 0.1%

LIMITS OF ERROR per square-root-year
± [ppm rdg + ppm fs] T_c ± 5°C

Range	Guaranteed	Typical	Temp. Coeff
0.1V	13 + 0.8	8 + 0.6	1.5
1V	13 + 0.4	8 + 0.4	1.3
10V	11 + 0.3	7 + 0.3	0.8
100V	14 + 0.4	8 + 0.4	1.6
1000V	13 + 0.3	8 + 0.3	1.5

Input Current, at T_c °C: <20pA
Range of Null: ±10% of range
Sample settling time: 13ms × (digits selected)

INTEGRATION TIME, TRACKING SPEED

Digits	Integration	Speed	Add Error
8½	51.2s	1/51.2s	--
7½	3.2s	1/3.2s	±2 digits
6½	0.4s	2.5/s	±1 digit
5½	0.1s	10/s	±1 digit
4½	6.25ms	85/s	±1 digit
3½	1.56ms	100/s	±1 digit

Overload Protection
Autorange: 1kV pk
Commanded range: 0.1, 1, 10V: 350V pk
100, 1000V: 1kV pk

7081 AC VOLTAGE True rms of ac or ac+dc Scale length 1 400 000

STABILITY
24hrs, T_c ± 1°C, ± [% reading + % full scale]

Range	Sensitivity	10 to 40Hz	40Hz to 10kHz	10k to 100kHz
0.1V	1μV	0.05 + 0.006	0.005 + 0.005	0.02 + 0.03
1V	1μV	0.05 + 0.006	0.005 + 0.005	0.02 + 0.03
10V	10μV	0.05 + 0.006	0.012 + 0.005	0.05 + 0.03
100V	100μV	0.06 + 0.006	0.017 + 0.005	0.20 + 0.03
1000V	1mV	0.08 + 0.01	0.035 + 0.007	

LIMITS OF ERROR
Error per square-root-year, T_c ± 5°C, ± [% reading + % full scale]

Range	10 to 40Hz	40Hz to 10kHz	10k to 100kHz	100k to 1MHz
0.1V	0.06 + 0.006	0.015 + 0.005	0.03 + 0.04	1 + 1
1V	0.06 + 0.006	0.015 + 0.005	0.03 + 0.04	1 + 1
10V	0.06 + 0.006	0.022 + 0.005	0.06 + 0.04	1 + 1
100V	0.07 + 0.006	0.027 + 0.005	0.21 + 0.04	
1000V	0.09 + 0.01	0.045 + 0.007	--	--

INTEGRATION TIME, TRACKING SPEED

Digits	Display	Integ	Speed	Add Error
8×9	6½	51.2s	1/51.2	--
7×9	6½	3.2s	1/3.2	--
6×9	5½	0.4s	2.5/s	--
5×9	4½	0.1s	10/s	±1 digit
4×9	3½	6.25ms	85/s	±1 digit
3×9	3½	1.56ms	100/s	±2 digits

Low Frequency Error

below 1kHz	use ~ Filt.
5 to 10Hz	add 0.25% rdg
3 to 5Hz	add 0.3% rdg
2 to 3Hz	add 0.6% rdg
1.5 to 2Hz	add 1.0% rdg
DC	add 0.1% rdg

Input Impedance: 1MΩ||150 pF
Temp. Coeff, up to 10kHz: ±30 ppm rdg/°C
Sample settling time: 20ms × (digits selected)
~ Filter selected: 400ms × (digits selected)

Maximum Inputs
Autorange: 1kV pk
Commanded range: 0.1, 1V: 350V pk
10, 100, 1000V: 1kV pk
Maximum V × Hz: 10^7
Crest Factor at fs: 5:1

7081 RESISTANCE Scale length 140 000 000

STABILITY 24hrs, 8½ digits
± [ppm rdg + ppm fs] T_c ± 1°C

Range	Sensitivity	Guaranteed	Transfer
0.1kΩ	10μΩ	2.0 + 0.8	0 + 0.8
1kΩ	10μΩ	2.0 + 0.4	0 + 0.4
10kΩ	100μΩ	1.5 + 0.3	0 + 0.3
100kΩ	1mΩ	2.0 + 0.4	0 + 0.4
1000kΩ	10mΩ	3.0 + 0.3	0 + 0.3
10MΩ	100mΩ	10 + 0.5	0 + 0.5
1000MΩ	1ppm rdg	1ppm/MΩ	--

Measurement: 4-wire, 0.1kΩ to 1000kΩ ranges
2-wire, 10MΩ and 1000MΩ range
Current source: 0.1, 1, 10kΩ 1mA
100kΩ, 1000kΩ 10μA
10MΩ, 1000MΩ 1μA max

LIMITS OF ERROR per square-root-year
± [ppm rdg + ppm fs] T_c ± 5°C

Range	Guaranteed	Temp. Coeff
0.1kΩ	16 + 1.0	1.5
1kΩ	16 + 0.5	1.5
10kΩ	14 + 0.5	1.2
100kΩ	16 + 0.5	1.5
1000kΩ	14 + 0.5	1.2
10MΩ	45 + 0.5	5.0
1000MΩ	10ppm/MΩ	1ppm/MΩ

Maximum total lead resistance: 1kΩ
Sample settling time: 13ms × (digits selected)
Add 10ms/MΩ

INTEGRATION TIME, TRACKING SPEED

Digits	Integration	Speed	Add Error
8½	51.2s	1/51.2s	--
7½	3.2s	1/3.2s	±2 digits
6½	0.4s	2.5/s	±1 digit
5½	0.1s	10/s	±1 digit
4½	6.25ms	85/s	±1 digit
3½	1.56ms	100/s	±1 digit

Overload protection: 350V pk
Open circuit voltage: 17V dc
Range of Null: ±10% of range

7081 AND 7071

INTERFERENCE REJECTION
Normal Mode Rejection, dc measurement
8½* to 5½ digits, 50(60) or 400Hz, ± 3% >70dB
Effective Common Mode Rejection
With 1kΩ imbalance.
DC measurement
8½* to 5½ digits, at 50(60)Hz, ± 3%: >140dB
8½* to 5½ digits, at 400Hz ± 3%: >120dB
AC measurement
Rejection of 50/60Hz ± 3%: >40dB
Maximum permitted common mode: 500V
*7½ for 7071

SYSTEMS USE
The following interfaces are provided as standard.
IEEE488 (1978)
Provides full talker/listener facilities and remote control of all functions.
Subset: SH1, AH1, T5, TE0, L3, LE0, E1, SR1, RL1, DC1, C0, DT1, PP1.

RS232C
Provides full remote control of all functions
Speed, user selectable: 110 to 9600 bits/s

Scanner
Interface provided for Minate (7010)
Channels: 16 to 128
Pull in and drop out delays: programmable
Additional control lines
External Sample: contact closure
Sample complete: TTL level
Out of limit High: open collector 40mA
Out of limit Low: open collector 40mA