11 SPECIFICATION

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 Schlumberger 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 proportional 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:

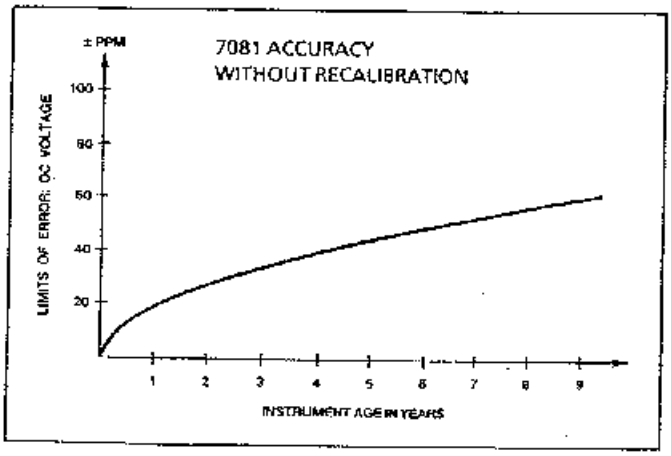
Required Spec Time	One Year Multiplier
3 months	0.5
6 months	0.7
1 year	1.0
2 years	1.4
4 years	2.0
9 years	3.0

CALIBRATED FOR LIFE

Beyond nine years the drift becomes insignificant such that three times the one year figure will predict the performance of the 7081 for the life of the voltmeter –however long that may be. Traceabiliy to International Standards can be maintained for long periods.

The square-root-year relationship applies to the 7081. The voltmeter will retain its predicted long term specification, even if subjected to rigorous working conditions. However, the best stabilty, and minimum long term drift, will be obtained by maintaining the voltmeter in a reasonable environment. The user should consider leaving the voltmeter 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, introduced for the first time by Schlumberger, 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*
with ac inputs >2% of range
and dc resistance with null in use.

Temperature Coefficient: expressed as ±ppm rdg/°C and valid from 10°C to 30°C.

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

Factory traceability to NPL is 1μV for standard cells, 1.5ppm for 10Vdc reference, 5ppm for resistors and 60ppm for AC/DC transfer.

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

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

If an instrument has been stored at below 5°C for long, follow the special warm-up procedure given in Chapter 2, Section 3.

RATIO

Differential measurement of Hi_{ref} and Lo_{ref} with respect to input Lo on a fixed 10V dc range to establish V_{ref}.

V_{ref}, maximum permitted input:	±14Vdc
V_{ref} error:	±2×error on 10V range
Ratio error:	±[V_m error + V_{ref} error]

DC VOLTAGE

Stability
24hrs, T_e ± 1°C, 8½ digits, ± [ppm rdg + ppm fs]

Range	Sensitivity	Full Scale	Guaranteed	Transfer
0.1V	10nV	0.140 000 00	2.0 + 0.8	0 + 0.8
1V	10nV	1.400 000 00	1.0 + 0.4	0 + 0.4
10V	100nV	14.000 000 0	0.5 + 0.3	0 + 0.3
100V	1µV	140.000 000	1.0 + 0.4	0 + 0.4
1000V	10µV	1000.000 00	2.0 + 0.3	0 + 0.3

Limits of error
8½ digits, T_e ± 3°C, ± [ppm rdg + ppm fs]

Range	90 Day	1 Year	2nd Year*	Temp. Coeff
0.1V	6 + 0.8	9 + 0.8	6 + 0.8	1.2
1V	5 + 0.4	7 + 0.4	5 + 0.4	1.0
10V	4 + 0.3	6 + 0.3	4 + 0.3	0.5
100V	5 + 0.4	8 + 0.4	5 + 0.4	1.3
1000V	6 + 0.3	9 + 0.3	6 + 0.3	1.3

Scale length, integration time, tracking speed

Scale	Digits	Integration	Speed	Add Error
8×9	8½	51.2s	1/51.2s	––
7×9	7½	3.2s	1/3.2s	±2 digits
6×9	6½	0.4s	2.5/s	±1 digit
5×9	5½	0.1s	10/s	±1 digit
4×9	4½	6.25ms	85/s	±1 digit
3×9	3½	1.56ms	100/s	±1 digit

Input Resistance: 0.1, 1, 10V range:	>10GΩ
100, 1000V range:	10MΩ
Input Current, at T_e °C:	<20pA
Range of Null:	±10% of range
Sample settling time:	13ms × (digits selected)

Overload Protection

Autorange:	1kV pk
Commanded range: 0.1, 1, 10V:	350V pk
100, 1000V:	1kV pk
Linearity:	<0.2ppm of fs

RESISTANCE

Stability
24hrs, T_e ± 1°C, 8½ digits, ± [ppm rdg + ppm fs]

Range	Sensitivity	Full Scale	Guaranteed	Transfer
0.1kΩ	10µΩ	0.140 000 00	2.0 + 0.8	0 + 0.8
1kΩ	10µΩ	1.400 000 00	1.5 + 0.4	0 + 0.4
10kΩ	100µΩ	14.000 000 0	1.5 + 0.3	0 + 0.3
100kΩ	1mΩ	140.000 000	1.5 + 0.4	0 + 0.4
1000kΩ	10mΩ	1400.000 00	2.0 + 0.3	0 + 0.3
10MΩ	100mΩ	14.000 000 0	8.0 + 0.5	0 + 0.5
1000MΩ	1ppm rdg	>1400.000	1ppm/MΩ	––

Limits of error
8½ digits, T_e ± 3°C, ± [ppm rdg + ppm fs]

Range	90 Day	1 Year	2nd Year*	Temp. Coeff
0.1kΩ	7 + 1.0	10 + 1.0	7 + 1.0	1.2
1kΩ	6 + 0.5	9 + 0.5	6 + 0.5	1.2
10kΩ	6 + 0.5	9 + 0.5	6 + 0.5	1.0
100kΩ	8 + 0.5	12 + 0.5	8 + 0.5	1.3
1000kΩ	8 + 0.5	12 + 0.5	8 + 0.5	1.2
10MΩ	20 + 0.5	30 + 0.5	20 + 0.5	4.0
1000MΩ	6ppm/MΩ	10ppm/MΩ	10ppm/MΩ	1ppm/MΩ

Scale length, integration time, tracking speed

Scale	Digits	Integration	Speed	Add Error
8×9	8½	51.2s	1/51.2	––
7×9	7½	3.2s	1/3.2	±2 digits
6×9	6½	0.4s	2.5/s	±1 digit
5×9	5½	0.1s	10/s	±1 digit
4×9	4½	6.25ms	85/s	±1 digit
3×9	3½	1.56ms	100/s	±1 digit

Measurement configuration:	4-wire, 0.1kΩ to 1000kΩ ranges		
	2-wire, 10MΩ and 1000MΩ range		
Current source, fully floating:	0.1, 1,	10kΩ	1mA
	100kΩ,	1000kΩ	10µA
	10MΩ,	1000MΩ	1µA max
Overload protection:			350V pk
Open circuit voltage:			17V dc
Range of Null:			±10% of range
Maximum total lead resistance:			1kΩ
Sample settling time:			13ms × (digits selected)
			Add 10ms/MΩ

* After first year recalibration

Traceability
The ability to relate individual measurements to International Standards through an unbroken chain of comparisons.

Transfer Accuracy
Transfer accuracy is the short-term limit of error for measurements of similar value.

Stability
The ability to remain within predefined error limits for a short time. The reading at the beginning of the time period is the datum for the limits.

AC VOLTAGE True rms of ac or ac+dc

Stability
24 hrs, 90 day, $T_e \pm 1°C$, ± [% reading + % full scale]

Range	Sensitivity	Full Scale	10 to 40Hz	40Hz to 10kHz	10k to 30kHz	30k to 100kHz	100k to 200kHz	200k to 1MHz
0.1V	1µV	0.140 000	0.05 + 0.006	0.005 + 0.005	0.015 + 0.015	**0.02 + 0.03**	0.2 + 0.2	1 + 1
1V	1µV	1.400 000	0.05 + 0.006	0.005 + 0.005	0.015 + 0.015	**0.02 + 0.03**	0.2 + 0.2	1 + 1
10V	10µV	14.000 00	0.05 + 0.006	0.012 + 0.005	0.03 + 0.02	**0.05 + 0.03**	0.3 + 0.2	1 + 1
100V	100µV	140.000 0	0.06 + 0.006	0.017 + 0.005	0.08 + 0.02	**0.20 + 0.03**	0.3 + 0.2	– –
1000V	1mV	1000.000	0.08 + 0.01	0.035 + 0.007	0.1 + 0.03	– –	– –	– –

Limits of error
1 Year, 2 Years, $T_e \pm 5°C$, ± [ppm rdg + ppm fs]

Range	Full Scale	10 to 40Hz	40Hz to 10kHz	10k to 30kHz	30k to 100kHz	100k to 200kHz	200k to 1MHz
0.1V	0.140 000	0.06 + 0.006	0.015 + 0.005	0.02 + 0.02	0.03 + 0.04	0.2 + 0.2	1 + 1
1V	1.400 000	0.06 + 0.006	0.015 + 0.005	0.02 + 0.02	0.03 + 0.04	0.2 + 0.2	1 + 1
10V	14.000 00	0.06 + 0.006	0.022 + 0.005	0.04 + 0.03	0.06 + 0.04	0.3 + 0.2	1 + 1
100V	140.000 0	0.07 + 0.006	0.027 + 0.005	0.1 + 0.03	0.21 + 0.04	0.3 + 0.2	– –
1000V	1000.000	0.09 + 0.01	0.045 + 0.007	0.15 + 0.04	– –	– –	– –

Scale length, integration time, tracking speed

Digits	Display	Integration	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. Coef. 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

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FUNCTIONS

Modes:	Vdc, Vac, Vac + dc, Filter (ac), Ohms, True Ohms, Ratio	
Ranging:	Auto or manual	
Scale length:	7081: 3½*, 4½*, 5½, 6½, 7½, 8½ *through remote control.	
Additional:	Local, Null, Null On, SRQ, Self Test, History forward, History reverse, Compute On/Off, Compute History, History clear, Help, clear results.	
Programs:	Ratio	8 subsets
	Digital Filter	3 subsets
	Scale and offset	
	Statistics	6 subsets
	Limits	8 subsets
	Time, real or elapsed	
History File:	1500 readings numeric only	
	500 Readings with time, channel mode,	
	History number recircultating or fixed	
	Selectable dump facility	

SYSTEMS USE

The following interfaces are provided as standard.

IEEE 488 (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 Minute (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

SYSTEMS LANGUAGE

The 7081 is programmed by use of ENGLISH words. These may be of a full or shortened form, and conform to recommended practices set out in 1981 draft 'Code and format conventions for use with IEEE standard 488 (1978)'.

A 'HELP' facility is available for ease of programming.

INTERFERENCE REJECTION

Normal Mode Rejection, dc measurement,

8½ to 5½ digits at 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 dc or pk

GENERAL

Power Supply

Voltage:	100/120/220/240V +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)