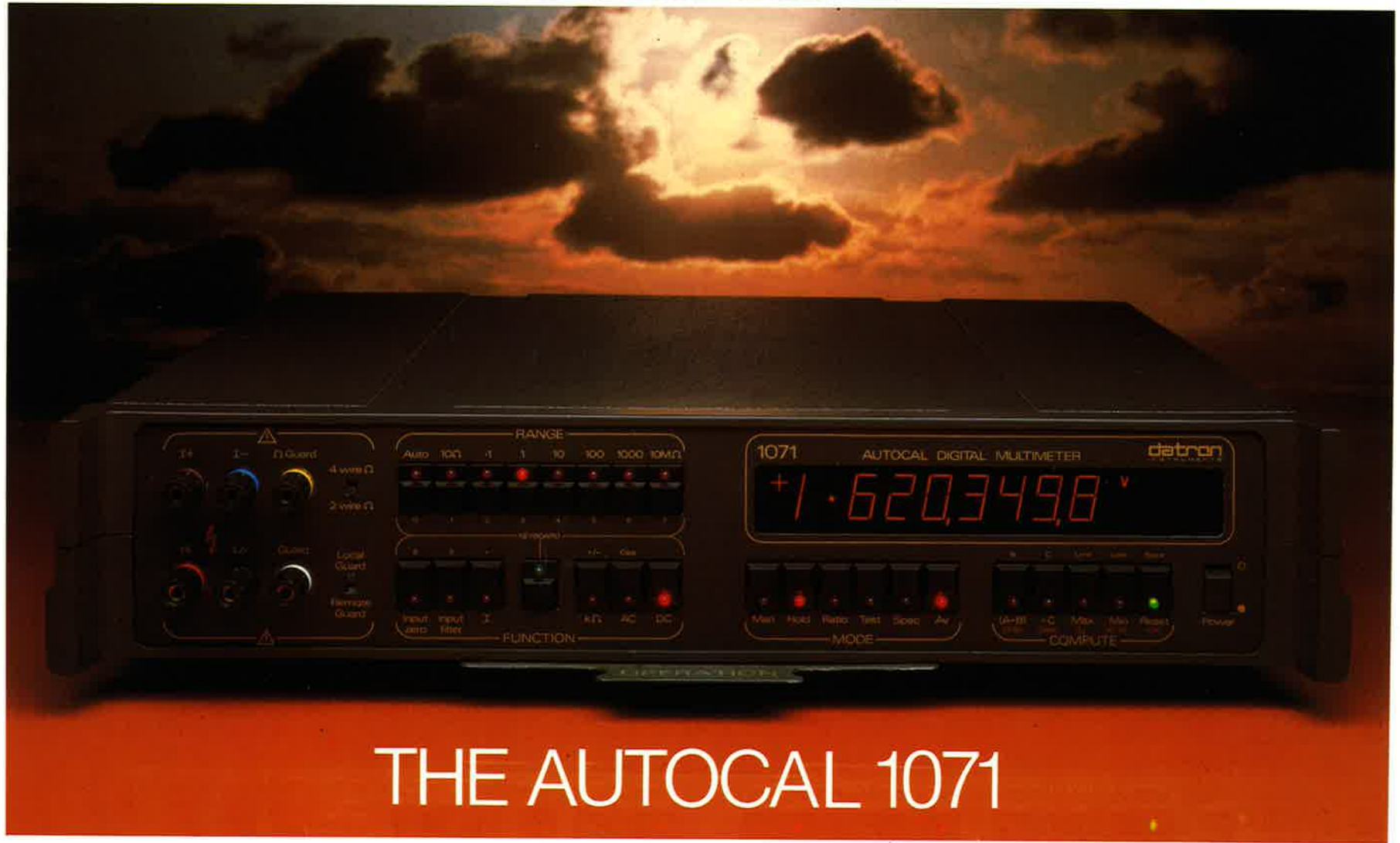


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# THE AUTOCAL 1071

FROM THE WORLDS FINEST RANGE  
OF DIGITAL MULTIMETERS



Datron's versatile AUTOCAL range of high quality, precision multimeters includes instruments to satisfy the complete spectrum of measurement requirements from the general purpose capability of the 1065 to the Standards Laboratory precision of the 1081. Each instrument in the AUTOCAL range has been designed to achieve optimum performance in its class and standard features include, among others, instant read-out of limits of uncertainty; specially designed high brightness displays with floating points for ease of reading; full computing functions; hinged, plug in PCBs and complete electronic calibration from its own front panel.

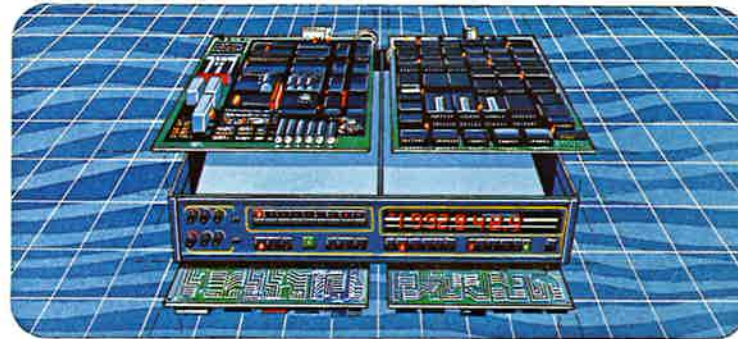


The well established 1071 has been designed to be at the upper end of the AUTOCAL range of digital multimeters. With its key features of high accuracy and resolution, the 1071 is a 6½ – 7½ digit instrument. Designed for calibration laboratory applications, the 1071 also has application in precision systems.

The instrument can be supplied

**datron**  
INSTRUMENTS

to meet the customer's individual requirements simply as a basic DC voltmeter or, with a combination of



additional options as follows:

- \* True RMS AC Voltage,
- \* Resistance,
- \* Current,
- \* Comprehensive Ratio and Rear Input,
- \* IEEE-488 Digital Interface,
- \* Analog Output.

'Compute' facilities are fitted as standard, including a numerical keyboard and memories which can be manipulated in a variety of ways to enhance the measurement performance of the 1071. Two of the memories are used to continuously monitor maximum and minimum readings while others can store readings, keyboard values or alarm limits, to be applied to measured data before display.

The 1071, with its high degree of accuracy and versatility, has already proved to be the ideal DMM for many laboratory applications and is

increasingly becoming adopted as a standard in calibration laboratories around the world.

## Accuracy

The high accuracy of the 1071 on all functions is a direct result of great attention to detail at all stages of design. Based on a new multi-slope analog to digital converter optimised for low noise performance, 100% OVERRANGE IS PROVIDED THROUGHOUT, RESULTING IN A 20,000,000 SCALE LENGTH OF EXCEPTIONAL LINEARITY. This has the specific benefit of increasing the accuracy between full range and 200% of full range enabling the operator to realise the superb performance of the 1071 in all measurement situations.

The preamplifier used on DC volts, DC Current and Resistance functions employs hermetically sealed, glass-encapsulated, wire-wound resistors in a configuration

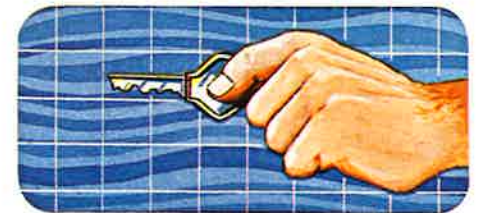
which provides decade switching using only three identical and optimally matched gain defining resistors for basic ranges.

Long term stability is dependent on the internal reference circuitry, which in the 1071 uses two compensated zener references processed and monitored in Datron's computer controlled conditioning and selection system.

On AC Volts and AC Current, full use is made of the Datron 'Log Feedback' solid state true RMS technique, producing exceptional AC measurement accuracies to 0.02%R ± 0.01% FS for AC Volts and 0.1%R ± 0.05% FS for AC Current. The circuit is not wave-shape dependent, accommodating crest factors of 7:1; it is fast and operates over a wide dynamic range, thus overcoming the problems of slower thermal methods.

## Autocal

This calibration technique is an integral part of achieving the outstanding specifications of the 1071.



AUTOCAL enables the calibration of DMMs to be implemented without removing covers which means the

internal thermal equilibrium remains undisturbed and avoids the necessity for additional stabilization time.

The process is fast and complete. Calibration constants are stored for zeros and gains on all functions and, using a digitally controlled analog compensation loop, parameters such as high frequency on AC Volts, A-D linearity and terminal input current can also be calibrated.

The addition of IEEE-488 means that 'hands-off' remote calibration becomes a reality, with protection against accidental or unauthorised use provided by a password code in addition to the normal 'calibration enable' key-switch. The AUTOCAL process also allows for direct calibration to other than just nominal value sources such as a standard cell. The actual value can be entered using the 1071 front panel keyboard, eliminating the uncertainties of additional transfer equipment – yet another reason why AUTOCAL maximises the accuracy of the 1071.

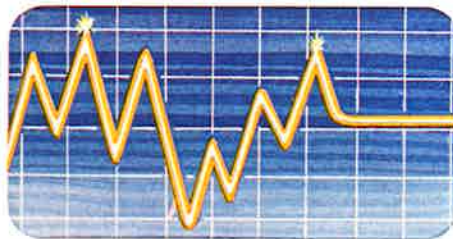
## Averaging

The averaging facility provided as standard on the 1071 can be used to extend the performance on all measurement functions. On DCV and Resistance, for example, the selection of 'Av' extends the scale length to 7½ digits on all ranges to produce a 0.05 ppm FS resolution. Additionally 'Av' can smooth a noisy input signal characteristic to

produce a stable reading which is particularly useful when using LF ACV or ACI.

Two modes of 'Av' are selectable: firstly, 'continuous', where all subsequent readings are taken into account, and secondly, 'block', where the user can select any number up to 19,999 readings to be averaged.

With a stable signal no amount of simple averaging can produce a real increase in accuracy. The 1071 however employs a new technique where in every group of 16 readings, each reading is internally offset from the next by 1/16 digit before the average value is determined. In this way a useful increase in accuracy, of typically two times, is achieved.



This averaging technique is used to provide extra displayed resolution on DCV and Ohms when 'Input filter' is selected and also, to add sub-digit resolution when 'AUTOCAL' or 'Input zero' is being performed.

## Ratio

With the addition of the Ratio & Rear input option, the 1071 gives

first class ratio measurement performance. Utilizing the computational and control capabilities of the micro-processor, the DMM is able to take consecutive readings on each of two fully isolated rear input channels, digitise each in turn, and



compute the ratio, which is then displayed in percent. Furthermore, by selecting autorange, the ratio of such widely varying inputs as 350 volts peak to a few millivolts is measured automatically.

Ratios can be made on any function i.e. DCV/DCV, etc., but on ACV, DC coupling can be selected, therefore providing true RMS AC/DC ratio measurement i.e. AC/DC transfers.

## Calibration Systems

With the addition of the IEEE-488 interface the 1071 becomes a powerful systems measurement instrument. Ideally suited for calibration systems, it is also a cost effective solution in Precision A.T.E. and Data Logging systems.

## Diagnostics

An extensive diagnostic self-

check routine is incorporated which sequentially checks all displays, individual measuring circuits and, most importantly, the non-volatile calibration memory. At any stage, an error code indicates failure to individual module level.

Each main function circuit is confined to a separate plug-in module which can be hinged-out and kept operational for easy servicing. The whole instrument is designed to withstand military type environments and a high level of user misuse. Input protection, for example, permits 1000V RMS to be connected indefinitely to any voltage range and a special 'Time-Guard' circuit protects against the inadvertent selection of damaging push-button combinations.



The 1071 carries Datron's full and comprehensive five year warranty with free annual calibration. For maximum economy, the 1072 is also available with the full performance of the 1071 in a fixed configuration which includes DCV, true RMS ACV, Resistance, Selectable Rear Input and IEEE-488 interface as standard with a one year warranty.

# 1071/2 Specifications

	RANGES	OVERRANGE	6½ (7½) digits ACCURACY ± ppm reading ± digits				TEMPERATURE COEFFICIENT
			Ranges	24 Hours [2] (23°C ± 1°C)	90 Days (23°C ± 5°C)	1 Year (23°C ± 5°C)	
DC VOLTAGE	0-100.0000 (0) mV 0-1.000000 (0) V 0-10.00000 (0) V 0-100.0000 (0) V 0-1000.000 (0) V	100% on all ranges except 1000V, i.e. 1,999,999 (9) Full Scale	100mV 1V 10V 100V 1000V	4 ± 4 (40) 3 ± 2 (20) 3 ± 2 (20) 4 ± 2 (20) 4 ± 2 (20)	20 ± 5 (50) 15 ± 3 (30) 15 ± 3 (30) 20 ± 3 (30) 20 ± 3 (30)	30 ± 6 (60) 20 ± 4 (40) 20 ± 4 (40) 30 ± 4 (40) 30 ± 4 (40)	1/10th 90 day accuracy/°C ± 0.3µV/°C
AC VOLTAGE True RMS [1]	0-100.000mV 0-1.00000V 0-10.0000V 0-100.000V 0-1000.00V	100% on all ranges, except 1000V, i.e. 199,999 Full Scale	DC+ 45Hz-5kHz [3]: 100mV & 1000V 1V-100V DC + 5kHz-100kHz: 100mV & 1000V 1V-100V DC + 100kHz-1MHz: 1V & 10V	0.04% ± 40 0.02% ± 20 0.1% ± 100 0.05% ± 50	0.08% ± 40 0.04% ± 20 0.2% ± 100 0.1% ± 50	0.12% ± 40 0.06% ± 20 0.3% ± 100 0.15% ± 50	1/10th 90 day accuracy/°C
RESISTANCE	0-10.00000 (0) Ω 0-100.0000 (0) Ω 0-1.000000 (0) kΩ 0-10.00000 (0) kΩ 0-100.0000 (0) kΩ 0-1000.000 (0) kΩ 0-10.00000 (0) MΩ	100% on all ranges, i.e. 1,999,999 (9) Full Scale	10Ω 100Ω 1kΩ 10kΩ 100kΩ 1000kΩ 10MΩ	10 ± 8 (80) 5 ± 2 (20) 5 ± 2 (20) 5 ± 2 (20) 10 ± 2 (20) 20 ± 2 (20) 100 ± 2 (20)	30 ± 8 (80) 20 ± 4 (40) 20 ± 4 (40) 20 ± 4 (40) 30 ± 4 (40) 80 ± 4 (40) 240 ± 4 (40)	40 ± 10 (100) 30 ± 6 (60) 30 ± 6 (60) 30 ± 6 (60) 40 ± 6 (60) 120 ± 6 (60) 360 ± 6 (60)	1/10th 90 day accuracy/°C ± 100µΩ/°C
DC CURRENT	0-100.000µA 0-1.00000mA 0-10.0000mA 0-100.000mA 0-1.00000A	100% on all ranges i.e. 199,999 Full Scale	100µA 1mA 10mA 100mA 1A	50 ± 4 50 ± 4 50 ± 4 50 ± 4 100 ± 4	100 ± 4 100 ± 4 100 ± 4 100 ± 4 200 ± 4	150 ± 4 150 ± 4 150 ± 4 150 ± 4 300 ± 4	1/10th 90 day accuracy/°C
AC CURRENT True RMS	0-100.000µA 0-1.00000mA 0-10.0000mA 0-100.000mA 0-1.00000A	100% on all ranges, i.e. 199,999 Full Scale	100µA 1mA 10mA 100mA 1A All ranges, > 0.1%FS, DC + 45Hz-5kHz [3] [4]	0.1% ± 100 0.1% ± 100 0.1% ± 100 0.1% ± 100 0.1% ± 100	0.2% ± 100 0.2% ± 100 0.2% ± 100 0.2% ± 100 0.2% ± 100	0.3% ± 100 0.3% ± 100 0.3% ± 100 0.3% ± 100 0.3% ± 100	1/10th 90 day accuracy/°C

Figures marked in red denote high resolution mode giving 7½ digits on DCV & Resistance with accuracy typically twice as good.

Example: DCV, 10V range, 24 hr, 10V input:-  
Accuracy is 3ppm ± 20 digits = 5ppm guaranteed or 2.5ppm typical

SETTLING TIME	COMMON MODE REJECTION RATIO (1kΩ Source Unbalance)	INPUT IMPEDANCE	OTHER SPECIFICATIONS
To 10ppm of Step Size: Filter out <50ms Filter in < 1s	>140dB at DC >80dB + Normal mode at 1Hz – 60Hz	0.1 to 10V ranges (<20V): >10,000MΩ 100V & 1000V ranges: 10MΩ ± 0.1%	Type: multi-slope A – D converter Ratio Accuracy [5]: ± net signal accuracy ± net reference accuracy Read Rate: 2/s Normal mode rejection: filter out: 66dB at 50/60Hz ± 0.15% filter in: 120dB at 50Hz increasing at 18dB/octave Input Current: <50pA drifting at <2pA/°C Input Protection: withstands 1000V RMS on any range
To 0.1% of Step Size: Filter out <150ms Filter in <500ms	>90dB at DC – 60Hz	1MΩ shunted by 150pF	Type: true RMS, AC coupled, measures AC component with up to 1000V DC bias on any range By pressing AC and DC keys, DC coupled true RMS AC is obtained, i.e. $\sqrt{AC^2 + DC^2}$ Ratio Accuracy [5]: ± net signal accuracy ± net reference accuracy Read Rate: 2/s Crest Factor: 7:1 at full range Input Protection: withstands 1000V RMS on any range
Up to 10kΩ range: generally the same as DC Voltage, but depends on external capacitances & guarding/shielding techniques used	–	–	Type: true 4 wire with active guard (250Ω minimum), can be switched to 2 wire on front panel Ratio Accuracy [5]: ± net signal accuracy ± net reference accuracy Read Rate: 2/s Open Circuit Voltage: <10V all ranges Lead Resistance: up to 100Ω Current Through: 10Ω : 10mA      100kΩ : 10μA Unknown: 100Ω : 10mA      1000kΩ : 1μA 1kΩ : 1mA      10MΩ : 100nA 10kΩ : 100μA
To 10ppm of Step Size: Filter out <50ms Filter in <1s	–	–	Type: multi-slope A – D converter Ratio Accuracy [5]: ± net signal accuracy ± net reference accuracy Read Rate: 2/s Shunt Resistance: 100μA : 1kΩ      Input Protection: <2A, internally clamped 1mA : 100Ω      >2A, rear panel fuse 10mA : 10Ω 100mA : 1Ω 1A : 100mΩ
To 0.1% of Step Size: Filter out <150ms Filter in <500ms	–	–	Type: true RMS, AC coupled By pressing AC and DC keys, DC coupled true RMS AC is obtained i.e. $\sqrt{AC^2 \pm DC^2}$ Ratio Accuracy [5]: ± net signal accuracy ± net reference accuracy Read Rate: 2/s Shunt Resistance: 100μA : 1kΩ      Crest Factor: 3:1 at full range 1mA : 100Ω      Input Protection: <2A, internally clamped 10mA : 10Ω      >2A, rear panel fuse 100mA : 1Ω 1A : 100mΩ

NOTES: [1] – Signals <2 x 10<sup>7</sup> volt. Hz >0.25% FS  
[2] – Relative to calibration standards  
[3] – 360Hz instead of 45Hz if 'Input filter' not selected  
[4] – Typical from 1kHz to 5kHz  
[5] – At same amplitude, frequency etc. errors tend to zero.

## GENERAL

POWER SUPPLY	105–127 volts or 205–255 volts 50Hz, 60Hz or 400Hz
POWER CONSUMPTION	20 watts approx.
OPERATING TEMP.	0°C to + 50°C
STORAGE TEMP.	– 40°C to + 70°C
DIMENSIONS (HxWxD)	89mm (3.5") x 455mm (17.9") x 420mm (16.5")
WEIGHT	10 kg (22 lbs)
SAFETY	Designed to UL1244, IEC 348 & BS 4743
WARRANTY	5 YEARS 1071 1 YEAR 1072

## ORDERING INFORMATION

1072: 6½/7½ digit AUTOCAL multimeter with DCV, ACV, Resistance, IEEE-488 and Selectable Front/Rear Input

PRICE \$

		5295
Option 30:	Current Converter	595
Option 40:	Comprehensive Ratio & Rear Input	595
Option 70:	Analog Output	100
Option 90:	Rack Mounting Kit	50

1071: 6½/7½ Digit AUTOCAL DC Multimeter

4950

Option 10:	True RMS AC Converter	795
Option 20:	4-Wire Resistance Converter	595
Option 30:	Current Converter	595
Option 40:	Comprehensive Ratio and Rear Input	595
Option 41:	Selectable Rear Input	100
Option 50:	IEEE-488 1978 Standard Digital Interface	595
Option 52:	Remote Trigger	150
Option 70:	Analog Output	100
Option 80:	115V 60Hz Line Operation	n/c
Option 81:	115V 50Hz Line Operation	n/c
Option 82:	115V 400Hz Line Operation	n/c
Option 90:	Rack Mounting Kit	50
Accessories		
CSI	Current Shunt Set	375
HVP	High Voltage Probe	375
1501	Deluxe Lead Kit	100

## The Autocal Range of Premium Digital Multimeters and Calibrators



There is a short form catalogue available with information on the complete AUTOCAL range of high quality, precision multimeters and calibrators. Individual brochures on each instrument contain more detailed information, with full specifications. Contact us now and we will be pleased to send you the information you need.



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