



— THE MODEL 4708 —  
AUTOCAL MULTIFUNCTION STANDARD





## THE WORLD'S MOST ACCURATE MULTIFUNCTION CALIBRATOR

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- The Ultimate in Very High Performance Multifunction Calibrators: total 1 year  $\pm 5^\circ\text{C}$  uncertainties to better than 4.7ppm (DCV) and 40ppm (ACV).
- Flexibility for the Future – Configure as DCV only, ACV only or Fully Multifunction.
- Fully Variable ACV output from 10Hz to 1MHz, providing 1100V at 33kHz or 750V at 100kHz. No additional boost amplifier required.
- IEEE-488 Compatible.
- Extend Capabilities with the Model 4600 Autocal Transconductance Amplifier for high current calibration and the 4101B Software for PC-based automation.



## FLEXIBILITY

The 4708's architecture was designed so that the user may configure the unit to meet many different individual requirements. The basic mainframe may be configured with either the DCV option, the ACV option, or both, while the Resistance and Current option makes the unit fully multifunctional. Options may be retrofitted at any time, as required, ensuring that today's investment in equipment can be adapted to tomorrow's requirements.

## ACCURACY & CAPABILITY

The unrivalled DC performance of the 4708 is ultimately derived from its zener reference module, which is the result of Datron's many years commitment to zener diode research. This hermetically encapsulated reference module is highly stable – through design as well as conditioning and selection – and offers exceptional performance over a wide temperature span. This combination ensures that the 4708's state of the art stability is maintained without any adjustments – even under difficult ambient measurement conditions.

The reference voltage is fed to an electronic reference divider, which uses pulse width modulation techniques to generate exceptionally low noise DC voltages linear to within 0.1ppm of full scale for the entire life of the instrument.

These features are especially important when calibrating the latest  $7\frac{1}{2}$  and  $8\frac{1}{2}$  digit systems and standards DMMs.

The 4708 generates unrivalled AC Voltage accuracies at continuously variable frequencies from 10Hz to 1MHz. For even higher performance, any one of five spot calibrated frequencies per range may be selected, enabling the unit to achieve extremely low uncertainties, previously attainable only through the use of complex and laborious thermal transfer standards.

ACV outputs are controlled by a totally electronic, true RMS, internal AC/DC transfer process, which has a wider dynamic range, a faster settling time and superior performance over a wider frequency range than traditional thermal methods permit. The solid state design ensures that the output settling time is not only fast but also totally predictable. This means that manual measurements can be made faster, and software generation is greatly simplified when the 4708 is used in a system.

The vast majority of today's DMMs – including many of the lower performance bench and handheld models – require calibration at frequencies higher than 1kHz on their high voltage ranges. Datron's technological lead in the design of high voltage amplifiers has allowed the installation of a true, full capability 1000V range inside the 4708, so that it can drive high voltages into real loads at high frequencies, such as 1100V at 33kHz or 750V at 100kHz. This means that these high voltage – high frequency tests may be made without the use of a boost amplifier, saving purchase and support costs, size and weight.

Decade resistances are provided by a number of fixed value, hermetically sealed standard resistors, which are 4-wire or 2-wire connected to the output terminals using high isolation relay switches. In addition, the Resistance and Current option generates fully floating, high accuracy DC and AC currents to 2A, using a voltage to current converter driven from the DC and AC voltage sections of the instrument. If higher currents are required, the 4708 is slave mode compatible with the 4600 Autocal Transconductance Amplifier, which effectively provides the calibrator with an 11A DC and RMS AC range.

In short, as well as being the world's most accurate programmable Multifunction calibrator, features such as the internal 1000V amplifier, the high current capability, low weight, low distortion, low noise, high linearity, fast settling times, wide dynamic range and flat frequency response mean that the 4708 provides unmatched all-round practicality and capability.



The Error and Offset functions allow the user to apply an offset of up to  $\pm 2\%$  and a gain error of up to  $\pm 10\%$  to the displayed output value. Use of these two functions makes offset, gain and linearity testing of DMMs simple and straightforward.

Datron's patented Spec Readout function eliminates the need for a user to make complex and time-consuming calculations on uncertainties. A ROM-based lookup table stores the 4708 specifications for every range of every function, and the microprocessor automatically makes the calculation and displays the uncertainty in the measurement.

## PROGRAMMABILITY & SYSTEMS COMPATIBILITY

Every 4708 is equipped with an IEEE-488 interface as standard, to transform it from a bench top calibrator to a computer controllable systems instrument. Basic performance and speed are coupled with features such as programmable string terminators to enable it to adapt to a wide variety of systems configurations.

As well as ease and flexibility of control via the IEEE-488 digital interface, the 4708 provides all analog outputs from a single set of terminals, which are totally isolated when in the 'off' state, making analog connection within a test or calibration system very simple. Its ability to operate in an uncontrolled temperature environment means that the 4708 can be put to work in many different automated areas without having to worry about reduced performance or the need to compromise test specification requirements.

## SAFETY

With particular concern for user protection, Datron engineers have devised extensive safety features for the 4708. Specially designed safety terminals guard against accidental contact with live parts while front panel key control of sense and guard connections removes the need for fitting exposed copper links between terminals at dangerously high voltages.

The output of any potentially hazardous voltage requires a fixed sequence of keystrokes, while an audible alarm warns of imminent danger and continues whenever high voltage levels are present. These interlocks are fixed under hardware control which prevents the user inadvertently resetting to dangerous limits.

## AUTOCAL

When traceability is a requirement, 100% confidence in the calibration of an instrument is of paramount importance. The only way to be confident in a calibration is through a process of complete and rigorous verification against traceable external standards. The 4708 employs Autocal, the Datron pioneered calibration technique, which stores digital corrections for analog errors measured at calibration. Using only front panel keystrokes, or the equivalent IEEE-488 interface commands, this method is fast, simple, complete, fully traceable and protected from misuse by a rear panel keyswitch.

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## EASE OF USE

A major design objective of the 4708 was to make it simple and straightforward to operate. Rapid rolling up and down keys are used for fast and easy setting of amplitude and frequency, with two further keys provided to allow immediate selection of full range (eg 0.1, 1, 10 etc) and zero, the two most common DMM calibration points. For other values, once the required output is selected, decade switching may be performed with just one keypress, making it simple to calibrate at other test points.

**datron**  
INSTRUMENTS

# 4708 ABBREVIATED SPECIFICATIONS

FUNCTION	RANGE	FREQUENCY (Hz)	UNCERTAINTY $\pm$ (ppm Output + Floor)			
			24 Hour Relative to Cal Standards 23°C $\pm$ 1°C [1]	1 Year Total Uncertainty 23°C $\pm$ 5°C [2]	1 Year Spot Calibrated Total Uncertainty 23°C $\pm$ 5°C [2]	
DC VOLTAGE [3]	100.00 $\mu$ V to 100.00000mV 1.0000000V 10.000000V 100.00000V 1000.0000V		2 + 0.4 $\mu$ V 1 + 0.8 $\mu$ V 0.5 + 3 $\mu$ V 1 + 50 $\mu$ V 1 + 500 $\mu$ V	12 + 0.5 $\mu$ V 8 + 1 $\mu$ V 4.5 + 3 $\mu$ V 8 + 50 $\mu$ V 10 + 500 $\mu$ V		
AC VOLTAGE [6]	1.0000mV to 100.0000mV	10-31 32-330 300-10k 10k-33k 30k-100k 100k-330k 300k-1M	90 + 5 $\mu$ V 50 + 5 $\mu$ V 40 + 5 $\mu$ V 50 + 5 $\mu$ V 200 + 5 $\mu$ V 550 + 10 $\mu$ V [4] 1250 + 22 $\mu$ V [5]	140 + 6 $\mu$ V 100 + 6 $\mu$ V 90 + 6 $\mu$ V 240 + 6 $\mu$ V 750 + 6 $\mu$ V 1450 + 11 $\mu$ V [4] 2450 + 23 $\mu$ V [5]	120 + 6 $\mu$ V 80 + 6 $\mu$ V 70 + 6 $\mu$ V 220 + 6 $\mu$ V 530 + 6 $\mu$ V 800 + 6 $\mu$ V 1450 + 6 $\mu$ V	
	1.000000V	10-31 32-330 300-33k 30k-100k 100k-330k 300k-1M	60 + 30 $\mu$ V 30 + 20 $\mu$ V 20 + 10 $\mu$ V 50 + 20 $\mu$ V 150 + 100 $\mu$ V 900 + 400 $\mu$ V	110 + 30 $\mu$ V 70 + 20 $\mu$ V 60 + 10 $\mu$ V 130 + 20 $\mu$ V 350 + 100 $\mu$ V 1800 + 400 $\mu$ V	100 50 40 100 250 1300	
	10.00000V	10-31 32-330 300-33k 30k-100k 100k-330k 300k-1M	60 + 300 $\mu$ V 30 + 200 $\mu$ V 20 + 100 $\mu$ V 50 + 200 $\mu$ V 150 + 1mV 900 + 4mV	110 + 300 $\mu$ V 70 + 200 $\mu$ V 60 + 100 $\mu$ V 130 + 200 $\mu$ V 350 + 1mV 1800 + 4mV	100 50 50 100 250 1300	
	100.0000V	10-31 32-330 300-10k 10k-33k 30k-100k 100k-200k	70 + 3mV 40 + 2mV 30 + 1mV 40 + 2mV 70 + 3mV 250 + 10mV	120 + 3mV 80 + 2mV 70 + 1mV 80 + 2mV 170 + 3mV 600 + 10mV	100 60 60 60 130 400	
	1000.000V	45-330 300-10k 10k-33k 30k-100k [7]	110 + 20mV 70 + 20mV 110 + 20mV 650 + 40mV	170 + 20mV 130 + 20mV 190 + 20mV 1050 + 40mV	160 120 170 250	
RESISTANCE	10 $\Omega$		4	35		
	100 $\Omega$ & 1k $\Omega$		1.5	14		
	10k $\Omega$		1.5	13		
	100k $\Omega$		1.5	22		
	1M $\Omega$		4	42		
	10M $\Omega$ 100M $\Omega$		10 15	67 270		
DC CURRENT [9]	100.0000 $\mu$ A 1.000000mA 10.000000mA 100.0000mA 1.000000A 10.00000A [8]		10 + 2nA 5 + 10nA 5 + 100nA 5 + 1 $\mu$ A 10 + 20 $\mu$ A 30 + 500 $\mu$ A	109 + 2nA 49 + 10nA 49 + 100nA 49 + 1 $\mu$ A 121 + 20 $\mu$ A 150 + 500 $\mu$ A		
	AC CURRENT [9]	100.0000 $\mu$ A	10-1k 1k-5k	160 + 6nA 200 + 10nA	700 + 16nA 1150 + 20nA	450 800
		1.000000mA	10-1k 1k-5k	100 + 60nA 150 + 60nA	450 + 160nA 550 + 160nA	320 320
		10.000000mA	10-1k 1k-5k	100 + 0.6 $\mu$ A 150 + 0.6 $\mu$ A	450 + 1.6 $\mu$ A 550 + 1.6 $\mu$ A	320 320
		100.0000mA	10-1k 1k-5k	100 + 6 $\mu$ A 150 + 6 $\mu$ A	450 + 16 $\mu$ A 550 + 16 $\mu$ A	320 320
1.000000A		10-1k 1k-5k	400 + 60 $\mu$ A 550 + 100 $\mu$ A	600 + 160 $\mu$ A 850 + 200 $\mu$ A	350 500	
10.00000A [8]	10-1k 1k-5k 5k-20k	220 + 1.4mA 670 + 1.5mA 5000 + 25mA	520 + 1.5mA 1100 + 1.7mA 8000 + 30mA	480 770 5000		

GENERAL	
POWER	100/120/220/240V $\pm$ 10%, 50Hz or 60Hz, 370VA (660VA Max).
OPERATING TEMPERATURE	0°C to +50°C.
STORAGE TEMPERATURE	-40°C to +70°C.
DIMENSIONS (H $\times$ W $\times$ D)	178mm $\times$ 455mm $\times$ 563mm (7" $\times$ 17.9" $\times$ 22.2").
WEIGHT	36kg (80lbs).
SAFETY	Designed to UL1244, IEC348, BS4743.
WARRANTY	1 year.

## NOTES

- [1] Relative Uncertainty specifications include all the effects of stability, temperature coefficient, noise, linearity, line and load regulation.
- [2] Total Uncertainty specifications include all the effects listed in [1] plus calibration uncertainty relative to National Standards added arithmetically.
- [3] Output current 25mA, except for 100 $\mu$ V to 100mV ranges which have a 100 $\Omega$  output impedance.
- [4] Add 2 $\mu$ V for 10mV range and 20 $\mu$ V for 100mV range.
- [5] Add 18 $\mu$ V for 10mV range and 198 $\mu$ V for 100mV range.
- [6] Output current/impedance:  
1mV to 100mV: 30 $\Omega$   
1V: 25mA  
10V: 60mA  
100V: 120mA  
1000V: < 3.3kHz, 15mA;  
> 3.0kHz, 65mA.
- [7] 750V Max.
- [8] Requires Model 4600 Transconductance Amplifier.
- [9] Compliance 3Vrms to 2A, 2Vrms to 11A.

## ORDERING INFORMATION

4708MF: Multifunction Mainframe

Option 10: DC Voltage

Option 20: AC Voltage

Option 30: Ohms and Current (to 2A)

(Requires Option 10, or 20, or both)

Option 42: Alternative Rear Output

Option 90: Rack Mount Kit

4600: 11A Transconductance Amplifier

440151: Slave Mode Kit

Option 90: Rack Mount Kit



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## THE DATRON CALIBRATION & MEASUREMENT RANGE

**D**atron Instruments leads the world in the design and manufacture of programmable calibrators, automated calibration systems and digital multimeters. Complementing the Datron Instruments range, other divisions within the Group are also engaged in the production of some of the world's finest test instruments. To assist you, data sheets are available with more detailed product information and full specifications. Contact us now and we will be pleased to send you the information you require.

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