Datron – Innovation for Systems and Calibration

Datron Range and Autocal

The choice of Datron precision DMMs and Calibrators is extensive, with instruments to suit a broad range of different applications - from bench and system use in a production environment to the exacting measurements performed in Standards and Calibration Laboratories. Each instrument offered by Datron provides not only the excellent performance associated with a technological leader, but also the high quality of a well established international supplier.

One of the strongest themes which links all of the instruments is that of automated calibration, where innovation in its application can lead to both improved accuracies and ease of support. Techniques of automated calibration can be applied to instrumentation at different levels, but they all have the common objectives of reducing calibration downtime, and improving the reliability, repeatability, and accuracy of the process. In addition, because calibration may be carried out with the instrument on-site even in its A.T.E. rack if necessary - some of these benefits extend to the systems in which such instruments are used. These include reduced system downtime, lower spares and logistics costs, higher accuracy and increased confidence in the overall system measurement.

Datron is a pioneer in the field of automated calibration, and leads the market in three different but related areas: AUTOCAL, SELFCAL and PORTOCAL.

Autocal

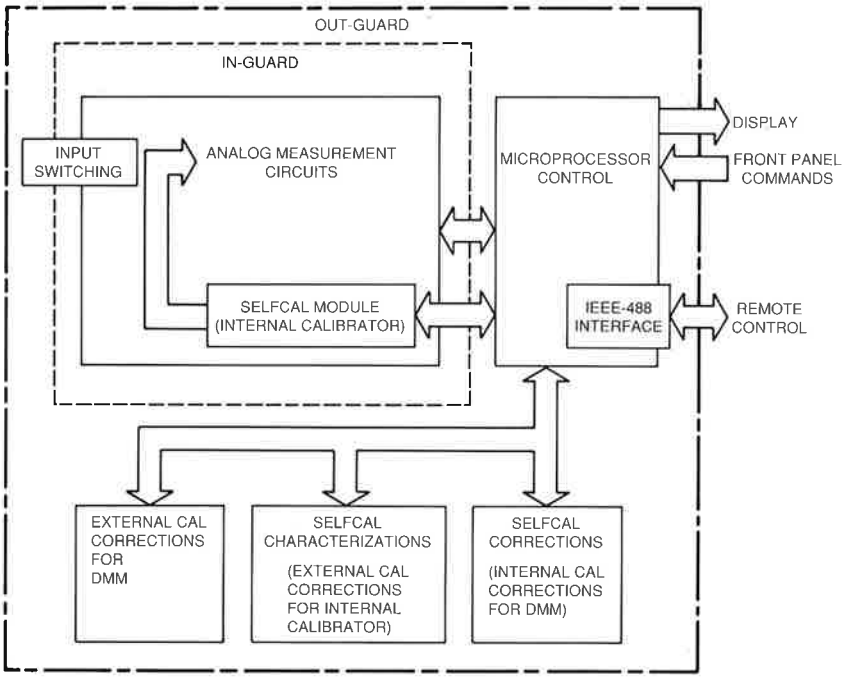
Before the development of Autocal, calibration of precision DMMs was undoubtedly one of the biggest headaches for the user. Calibration involved the removal of the DMM's covers, which in itself upset the thermal balance within the instrument, and then manually adjusting up to 30 or 40 trim-caps- each one tending to interact with the others. This meant that the whole calibration procedure was a long and complex process, requiring experienced and skilled personnel.

Taking advantage of a microprocessor's ability to make calculations and control analog circuitry, Datron was the first DMM manufacturer to develop complete, electronic covers-on calibration, Autocal. This technique has proved to be so successful that variations are employed by the vast majority of precision and systems DMMs available today.

Selfcal

As the pioneer of Autocal, Datron has taken advantage of its technological leadership in this area and has taken the concept one stage further - with Selfcal. Whereas Autocal is an electronic technique for calibrating equipment against external calibration standards, Selfcal - as embodied in Datron's model 1281 & 1271 DMMs - is a technique for calibration against traceable *internal* standards. Selfcal has all the benefits of Autocal plus one additional factor: the calibrator is actually inside the instrument - so you do not need an external source.

Embedded within the Selfcal DMMs normal measurement circuits is an accurate internal calibrator composed of highly stable zener diodes, reference resistors, and a precision transformer multiplier. During a Selfcal, the inherently stable turns ratio of the transformer multiplier is used to derive different levels of very high accuracy calibration signals from the DMM's zener references, which are then routed via an internal signal bus to all of the instrument's various functions. Over 150 different calibration measurements are used by the microprocessor to compute and store corrections for the effects of time and temperature drift in the DMM's circuits, significantly enhancing long term performance and temperature coefficient specifications. The result is a 2:1 improvement in temperature coefficient and a 35% improvement in performance over the identical instrument when used without Selfcal. This means the instrument is capable of maintaining its standards lab performance over longer periods before returning to the Calibration Laboratory. In addition, the ability to calibrate itself, even in an A.T.E. rack, gives the 1281 & 1271 the ability to perform very well in relatively hostile production environments.



The Models 1281 & 1271 contain separate calibration memories for the DMM and its internal calibrator. When the DMM calibrates itself against the internal calibrator, another set of calibration corrections are derived and stored.

Portocal
This is the name given to Datron's series of automated DMM calibration systems. The word is short for 'Portable Calibration', and is appropriate because these systems are compact and rugged enough to be wheeled around a factory installation to calibrate equipment on-site (e.g an Autocal DMM located in a A.T.E rack). All of Datron's Autocal and Selfcal instruments can be remotely controlled and calibrated via the IEEE-488 interface, which means that apart from being ideal for general systems applications, these instruments can also either form part of a computer controlled calibration system, or indeed be totally automatically calibrated by such a system. Datron provides comprehensive menu driven software to help users to develop automated calibration procedures for all kinds of DMMs. In addition, the system controller also manages the calibration data that is generated from using the system. This means that past results and comments can be retrieved very quickly, and presented in a high quality format - important facilities for the management of any calibration laboratory. Such systems, based on one of Datron's 4700 series of calibrators, can provide a very compact, accurate and yet cost-effective integrated solution for DMM calibration and data management.

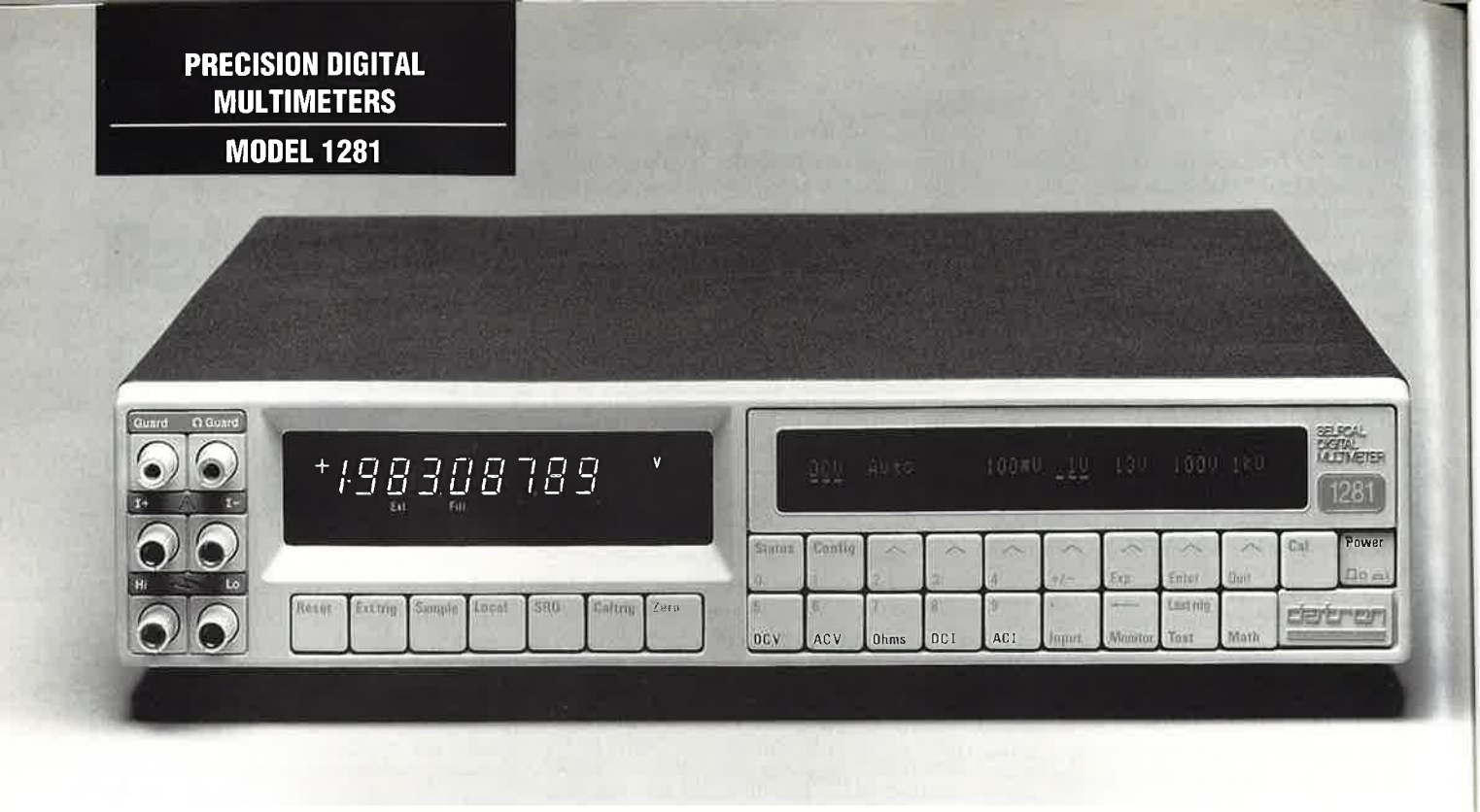
Innovation
As can be seen, being innovative with automated calibration techniques has allowed Datron to provide all kinds of measurement and support advantages for users of their instruments. Furthermore, these benefits are not just confined to the calibration laboratory, finding very real use in systems and other factory applications.

PRECISION DIGITAL MULTIMETERS

MODEL	RANGES	RESOLUTION (digits)	ACCURACY (1 Year, 23°C±5°C, ±(ppmR + ppm FS))	DIGITAL INTERFACE	OTHER FEATURES	PG	
1281	DCV: 100 mV to 1kV ACV: 100 mV to 1kV Ω: 10Ω to 1GΩ DCI: 100 µA to 1A ACI: 100 µA to 1A	DCV: 10 nV, 8 1/2 ACV: 100 nV, 6 1/2 Ω: 1 µΩ, 8 1/2 DCI: 100 pA, 6 1/2 ACI: 1 nA, 5 1/2	DCV: 3 + 0.1 ACV: 60 + 5 Ω: 6+ 0.3 DCI: 25 +2 ACI: 200 + 100	IEEE-488.2	Ratio/Rear Input Spot Frequency ACV Low Current Ohms Frequency SELFCAL/AUTOCAL Math/Limits/Max-Min Spec Readout	140	
1271	DCV: 100 mV to 1kV ACV: 100 mV to 1kV Ω: 10Ω to 10GΩ DCI: 100 µA to 1A ACI: 100 µA to 1A	DCV: 10 nV, 8 1/2 ACV: 100 nV, 6 1/2 Ω: 1 µΩ, 8 1/2 DCI: 100 pA, 6 1/2 ACI: 1 nA, 5 1/2	DCV: 7 + 0.25 ACV: 60 + 10 Ω: 10 + 0.5 DCI: 25 + 2 ACI:200 + 100	IEEE-488.2	Ratio/Rear Input Line-locking Ohms Guard Frequency SELFCAL/AUTOCAL Math/Limits/Max-Min Spec Readout	142	
1061A	DCV: 100 mV to 1kV ACV: 100 mV to 1kV Ω: 10Ω to 10 MΩ DCI: 100 µA to 1A ACI: 100 µA to 1A	DCV: 100 nV, 6 1/2 ACV: 10 nV, 6 1/2 Ω: 10 µΩ, 6 1/2 DCI: 1 nA, 5 1/2 ACI: 1 nA, 5 1/2	DCV: 30 + 4 ACV: 600 + 100 Ω: 45 + 4 DCI: 150 + 20 ACI: 0.3% + 0.05%	IEEE-488 BCD (1061 Only)	Ratio/Rear Input AUTOCAL Math/Limits/Max-Min dB/Spec Readout	144	
1062MT	DCV: 100 mV to 1kV ACV: 100 mV to 1kV Ω: 10Ω to 10 MΩ DCI: 100 µA to 1A ACI: 100 µA to 1A	DCV: 100 nV, 6 1/2 ACV: 1 µV, 5 1/2 Ω: 10 µΩ, 6 1/2 DCI: 1 nA, 5 1/2 ACI: 1 nA, 5 1/2	DCV: 30 + 4 ACV: 600 + 100 Ω: 45 + 4 DCI: 150 + 20 ACI: 0.3% + 0.05%	MATE IEEE-488	Rear Input AUTOCAL Math/Limits/Max-Min Spec Readout	144	
1062MT-5	DCV: 100 mV to 1kV ACV: 100 mV to 1kV Ω: 10Ω to 10 MΩ	DCV: 100 nV, 6 1/2 ACV: 1 µV, 5 1/2 Ω: 10 µΩ, 6 1/2	DCV: 60 + 4 ACV: 1000 + 250 Ω: 60 + 4	MATE IEEE-488	Rear Input AUTOCAL Math/Limits/Max-Min Spec Readout	144	
1362 VXIbus Card DMM	DCV:100 mV to 300V ACV:100 mV to 300V Ω:100Ω to 10 MΩ DCI: 1A ACI: 1A	DCV: 100 nV, 6 1/2 ACV: 100 nV,6 1/2 Ω: 100 µΩ, 6 1/2 DCI: 1 µA, 6 1/2 ACI: 1 µA, 6 1/2	DCV: 30 + 2 ACV: 400 + 100 Ω: 40 + 3 DCI: 300 + 10 ACI: 0.3% + 0.03%	VXI Compatible IEEE-488.2 or MATE(CIIL) command syntax	C size,single slot Ratio 1000 readings/sec CMRR >130 dB	10	

PRECISION DIGITAL MULTIMETERS

MODEL 1281



Selfcal Digital Multimeter

- **The World's Finest 8 1/2 Digit DMM**
- **1 Year DCV Specifications to ±3.1 ppm**
- **1 Year ACV Specifications to ±65 ppm**
- **Selfcal Internal Calibration**
- **Simultaneous Display of Frequency and True RMS ACV**

State of the Art Accuracy
A glance at the specifications opposite will confirm that the 8 1/2 digit 1281 Selfcal Digital Multimeter is, without exception, the finest DMM in the world. Designed with Standards and Calibration laboratories in mind, the 1281 provides the ultimate in electrical measurement, outperforming all rivals in accuracy, functional capability, and ease of use.

Selfcal
The impressive specifications of the 1281, achieved through a blend of innovation, experience and new component technology, are further enhanced by "Selfcal"— Datron's unique method of accurate internal calibration.

Embedded within the 1281's normal measurement circuits is an accurate, compact internal calibrator, based on an inherently stable precision transformer multiplier. This is used to derive different levels of very high accuracy calibration signals from the 1281's zener references, which are then routed to the various measurement circuits in order to calibrate them. Over 150 calibration measurements are used by the microprocessor to compute and store corrections for the effects of time and temperature drift in the 1281's circuits, significantly enhancing its long term performance and temperature coefficient specifications.

Applications
Long term accuracy and wide functional capability make the 1281 an obvious choice as a laboratory standard for the smaller calibration facility, while its short term stability and ease of calibration without removal of covers also makes it ideal for the short term transfer work appropriate to a Standards environment. In addition to its stability, the 1281's rugged construction and extensive selftesting capability (which can be carried out to very high precision due to the 1281's internal calibrator) are characteristics that lend it to audit applications, where laboratories can compare measurements knowing that the transfer instrument can check itself to a high degree of accuracy after transportation, and is highly stable over the period the measurements are taken.

Calibration Systems
Apart from enhancing accuracies, the 1281's ability to internally calibrate itself gives it a low effective temperature coefficient, which when combined with comprehensive control over the IEEE-488 interface makes the instrument an ideal component either for a mobile calibration system, or for integration within a high accuracy A.T.E. The low temperature coefficient means that the 1281 can deliver highly accurate measurements outside a controlled calibration environment.

Versatile
In addition to its basic measurement capability, the 1281 incorporates many features to enhance the usefulness of its fundamental performance. These include frequency measurements which can be displayed simultaneously with the true RMS value of the signal, low-current resistance modes which will

interest users of resistance thermometers, comprehensive autoranging ratio (including difference and deviation measurements), rolling and block averaging, linear math computations, dBs and automatic readout of measurement uncertainty.

DC Voltage

Ranges: 100 mV to 1000V in decades.
FS: 2 x Full Range. 100% Overrange. (Except 1kV range).
Resolution: 10 nV, 8 1/2 digits.
Accuracy: 1 Year, 23°C ± 5°C, ±(ppmR + ppmFS):

100 mV Range:	6 + 0.5
1V Range:	3 + 0.2
10V Range:	3 + 0.1
100V Range:	6 + 0.2
1000V Range:	6 + 0.2

CMRR: (1kΩ unbalance) >140 dB at DC, >(80 dB NMRR) at 1 Hz-60 Hz.
NMRR: 60 dB at 50/60 Hz ±0.09% (Filter out), 110 dB at 50/60 Hz (Filter in).
Input Impedance: >10,000 MΩ from 100 mV to 10V ranges, 10 MΩ ±0.1% on 100V and 1000V ranges.
Input Protection: Withstands 1kV RMS on any range.
Input Current: <50 pA.
Settling Time: (To 10ppm step size) <50 ms (Filter out), <1s (Filter in).
Read Rate: 1/6s at 8 1/2 digits, 150/s at 4 1/2 digits.

True RMS AC Voltage

Ranges: 100 mV to 1000V in decades.
FS: 2 x Full Range. 100% Overrange. (Except 1kV range).
Resolution: 100 nV, 6 1/2 digits.
Accuracy: 1 Year, 23°C ± 5°C, Signal >1%FS, ±(ppmR + ppmFS):

100 mV Range:	
40 Hz-10 kHz	100+20
10-30 kHz	300+40
30-100 kHz	700+100
1V to 100V Ranges:	
40-100 Hz	80+10
100 Hz-2 kHz	60+10
2-10 kHz	80+10
10-30 kHz	200+20
30-100 kHz	500+100
100-300 kHz	0.3%+0.1%
300 kHz-1 MHz	1%+1%
1000V Range:	
40 Hz-10 kHz	80+10
10-30 kHz	200+20
30-100 kHz	500+100

Lf Accuracy: (DC coupled. Add to main accuracy specs).

DC	±(50 ppmR+20 ppmFS+20 µV)
1 Hz-10 Hz	±(20 ppmR+50 ppmFS)
10 -40 Hz	±(20 ppmR)

CMRR: (1kΩ unbalance) >90dB at DC-60Hz.
Input Impedance: >1MΩ & 150 pF.
Input Protection: Withstands 1kV RMS on any range.
Crest factor: 5:1 at Full Range.
Max Volt-Hertz: 1 kV x 30 kHz
Settling Time: (To 100 ppm step size) <500ms (100Hz), <1.25s (40 Hz), <5s (10 Hz), <50s (1 Hz).
Read Rate: 1/s at 6 1/2 digits.

Spot Frequency AC Voltage:

Accuracy: 1 Year, 23°C ± 5°C, Signal >1%FS, ±(ppmR + ppmFS); Valid within ±10% of calibrated RMS value and Spot Frequency).

100 mV Range:	
40 Hz-10 kHz	100+10
10-30 kHz	150+25
30-100 kHz	500+100
1V to 100V Ranges:	
40 Hz-10 kHz	60+5
10-30 kHz	150+15
30-100 kHz	400+50
100-300 kHz	0.2%+0.05%
300 kHz-1 MHz	0.5%+0.3%
1000V Range:	
40 Hz-10 kHz	60+5
10-30 kHz	150+15
30-100 kHz	400+50

Resistance

Ranges: 10Ω to 1GΩ in decades.
FS: 2 x Full Range, 100% Overrange.
Resolution: 1 µΩ, 8 1/2 digits (Except 100 MΩ and 1 GΩ ranges).
Accuracy: 1 Year, 23°C ± 5°C, ±(ppmR + ppmFS):

10Ω Range:	12+1
100Ω to 10 kΩ Range:	8+0.3
100 kΩ Range:	6+0.2
1 MΩ Range:	10+0.7
10 MΩ Range:	20+4
100 MΩ Range:	200+45
1 GΩ Range:	0.2%+450

Open Circuit Voltage: <20V.
Lead Resistance: Up to 100Ω.

Current Through Unknown:	
10Ω and 100Ω	10 mA
1 kΩ	1 mA
10 kΩ and 10 0kΩ	100 µA
1 MΩ	10 µA
10 MΩ	1 µA
100 MΩ	100 nA
1 GΩ	10 nA

Input Protection: Withstands 250V RMS on any range.
Settling Time: Up to 100 kΩ generally the same as DCV.
Read Rate: 1/6s at 8 1/2 digits, 150/s at 4 1/2 digits

Low Current Resistance

Accuracy: 1 Year, 23°C ± 5°C, ±(ppmR + ppmFS):

10Ω to 1 kΩ Ranges:	12+1
10 kΩ Range:	15+1
100 kΩ Range:	70+3
1 MΩ Range:	400+10

Open Circuit Voltage: <0.2V.

Current Through Unknown:	
10Ω	10 mA
100Ω	1 mA
1 kΩ	100 µA
10 kΩ	10 µA
100 kΩ	1 µΩ
1 MΩ	100 nA

DC Current

Ranges: 100 µA to 1A in decades.
FS: 2 x Full Range. 100% Overrange.
Resolution: 100 pA, 6 1/2 digits.
Accuracy: 1 Year, 23°C ± 5°C, ±(ppmR + ppmFS):

100 µA to 10 mA Ranges:	25+2
100 mA Range:	50+5
1A Range:	150+10

AC Current

Ranges: 100 µA to 1A in decades.
FS: 2 x Full Range. 100% Overrange.
Resolution: 1 nA, 5 1/2 digits.
Accuracy: 1 Year, 23°C ± 5°C, ±(%R + %FS):

100 µA to 100 mA Range:	
40 Hz-5 kHz	200+100
1A Range:	
10 Hz-1 kHz	500+200
1-5 kHz	0.15%+0.04%

Frequency

Resolution: 4 1/2 or 6 1/2 digits.
Accuracy: (1 Year, 13°C to 33°C).
±10 ppmR + 2 digits (6 1/2 digits, 10 Hz - 1 MHz).
±2 digits (4 1/2 digits, 200 Hz - 1 MHz).
Sample Interval:
Fast Gate, 50 ms (4 1/2 digits).
Normal Gate, 1s (6 1/2 digits)

Ratio Accuracy

±(net signal accuracy + net reference accuracy).

GENERAL

Calibration: Selfcal internal calibration. Autocal external calibration from front panel or via IEEE-488 interface.
Remote Programming: IEEE-488.2
Environmental:
Operating temp: 0°C to +50°C.
Storage temp: -40°C to +70°C.
Dimensions: 88 mm (3.5 in.) high, 427 mm (16.8 in.) wide, 487 mm (19.2 in.) deep.
Weight: 13.5 kg (30 lb).
Power: 100-130 Vac or 200-260 Vac, 47 Hz-63 Hz, 37VA.

OPTIONS

10: True RMS AC Converter
20: 2-Wire and 4-Wire Resistance Converter
30: Current Converter. (Only available with Option 20)
70: Isolated Analog Output
80: 115V 60 Hz Line Operation
81: 115V 50 Hz Line Operation
90: Rack Mounting Kit

ACCESSORIES

1501: DMM Lead Kit

FACTORY/FOB

Indianapolis, IN & Norwich, England

ORDER INFORMATION

Model 1281
(Includes DCV, Ratio, Rear Inputs, IEEE-488.2, 1 Year Warranty)
Option 10
Option 20
Option 30
Option 70
Option 80
Option 81
Option 90
Accessory 1501

PRECISION DIGITAL MULTIMETERS

MODEL 1271

Selfcal Digital Multimeter

- **A DMM for the System Specialist**
- **Functional Capability & High Accuracy**
- **1000/sec, 5 1/2 Digit Readings**
- **IEEE 488.2 Compatible**
- **Outstanding Diagnostics**

The Datron 1271 is a Premium Digital Multimeter designed for the system specialist. It has a performance optimized for military and aerospace test applications and is a significant addition to the Datron Selfcal range of DMMs.

Premium Systems Performance
With DCV and IEEE-488 bus control fitted as standard, the model 1271 also offers individual Ohms, Ratio, DCI & ACI options and two versions of ACV to produce unrivalled combinations of performance and price.

High accuracy is provided across all functions, and with scale lengths from 5 1/2 to 8 1/2 digits and resolutions to 1 part in 200 million, a useful range of read-rates is achieved.

With systems use firmly in mind, the 1271 incorporates a variety of dedicated facilities. Maths processing, reading storage and limit testing are available on all functions. Included with Ohms are active guarding, low source currents and true ohms modes, maintaining accuracy in difficult measurement applications.

Selfcal & Autocal
The high accuracy claims of the 1271 are supported by two independent calibration techniques, AUTOCAL and SELFCAL, both offering guaranteed traceability to provide the highest possible calibration confidence. Autocal provides for complete direct calibration against external certified standards. Selfcal, which relies only on internal standards, can be initiated at any time, and in a 10 minute sequence re-calibrates all functions and ranges.

Noise Rejection
Line related EMI can degrade the performance of any DMM's functions, and to combat this, the critical timing waveforms of the 1271 digitizer precisely sychronize with the frequency of the incoming power line. The effect of this line-locking is to present a deep and narrow 60 dB continuously tracking rejection notch at line frequency. In cases of excessive wideband noise, on DCV & Ohms where unstable readings could occur, a selectable 2 pole active filter can be introduced to provide a further 40 dB above line frequency.

Continuous Operation
The 1271 has been designed to withstand the rigors of continuous operation in military type environments.
With a tough exterior and rigid modular construction, the 1271 meets the environmental, reliability and maintainability requirements of MIL-T28800C (Type III, Class 5, Style E).

No exhaust fans or cooling inlets are used, and with the terminals retracted the enclosure is sealed and ideally suited for mobile activity. High level protection is fitted to all inputs, enabling 1kV RMS to be applied continuously on the most sensitive voltage ranges.

Exceptional Self - Test
The DMM is often the instrument most fundamental to the integrity of overall system performance. Of paramount importance therefore is the facility to conduct regular, fast and effective self-checks. In the 1271, full use has been

made of the SELFCAL source to provide early warning of potential problems by using a selectable two level diagnostic routine. First level checks monitor key circuit operation in a high speed, one minute sequence. The full test mode includes more that 250 checks at critical points in the 1271, and using the full accuracy of the SELFCAL calibrator, precise, accuracy checks are made on every function and range. As a final check, noise tests are conducted at all zero and cardinal points, and at any stage error codes are output to pinpoint failures or areas of weakness.

SPECIFICATIONS

DC Voltage

Ranges: 100 mV to 1000V in decades.
FS: 2 x Full Range. 100% Overrange. (Except 1kV range).
Resolution: 10 nV, 8 1/2 digits.
Accuracy: 1 Year, 23°C ± 5°C, ±(ppmR + ppmFS):

100 mV Range:	10 + 1
1V Range:	8 + 0.5
10V Range:	7 + 0.25
100V Range:	8 + 0.5
1000V Range:	10 + 1

CMRR: (1kΩ unbalance) >140 dB at DC, >(80 dBNMRR) at 1 Hz-60 Hz.
NMRR: 60 dB at line frequency (Filter out), add 40 dB at 50/60 Hz + 12dB/octave (Filter in).
Input Impedance: >10,000 MΩ from 100 mV to 10V ranges, 10 MΩ ±0.1% on 100V and 1000V ranges.
Input Protection: Withstands 1kV RMS on any range.
Input Current: <50 pA.
Settling Time: (To 10 ppm step size) <500 µs (Filter out), <500 ms (Filter in).
Read Rate: 3/s at 7 1/2 digits, 1000/s at 5 1/2 digits.

True RMS AC Voltage (High Speed)

Ranges: 100 mV to 1000V in decades.
FS: 2 x Full Range. 100% Overrange. (Except 1kV range).
Resolution: 100 nV, 6 1/2 digits.
Accuracy: 1 Year, 23°C ± 5°C, Signal >1%FS, ±(ppmR + ppmFS):
100 mV & 1000V Ranges:

40 Hz-2 kHz	250+70
2-20 kHz	400+120
20-100 kHz	0.16%+0.022%

1V to 100V Ranges:

40-20 kHz	200+50
20-100 kHz	0.1%+0.02%
100-300 kHz	1%+1%
300-1 MHz	2%+2%

Settling Time: (To 100 ppm step size) <30 ms (1 kHz), <100 ms (360 Hz).
Read Rate: 20/s at 6 1/2 digits.

True RMS AC Voltage (High Accuracy)

Ranges: 100 mV to 1000V in decades.
FS: 2 x Full Range. 100% Overrange. (Except 1kV range).
Resolution: 100 nV, 6 digits.
Accuracy: 1 Year, 23°C ± 5°C, Signal >1%FS, ±(ppmR + ppmFS):
100 mV Range:

40 Hz-10 kHz	100+20
10-30 kHz	300+40
30-100 kHz	700+100

1V to 100V Ranges:

40-100 Hz	80+10
100 Hz-2 kHz	60+10
2-10 kHz	80+10
10-30 kHz	200+20
30-100 kHz	500+100
100-300 kHz	0.3%+0.1%
300 kHz-1 MHz	1%+1%

1000V Range:

40 Hz-10 kHz	80+10
10-30 kHz	200+20
30-100 kHz	500+100

Settling Time: (To 100 ppm step size) <500 ms (100Hz), <1s (40 Hz), <5s (10 Hz), <50s (1Hz).
Read Rate: 1/s at 6 1/2 digits.
Lf Accuracy: (DC coupled. Add to main accuracy specs).

DC	±(50 ppmR+20 ppmFS+20 µV)
1 Hz-10 Hz	±(20 ppmR+50 ppmFS)
10-40 Hz	±(20 ppmR)

CMRR: (1kΩ unbalance) >90dB at DC-60Hz.
Input Impedance: >1 MΩ shunted by 150 pF.
Input Protection: Withstands 1kV RMS on any range.
Crest factor: 5:1 at Full Range.
Max Volt-Hertz: 1 kV x 30 kV.

Resistance

Ranges: 10Ω to 1GΩ in decades.
FS: 2 x Full Range, 100% Overrange.
Resolution: 1 µΩ, 8 1/2 digits (Except 100 MΩ and 1 GΩ ranges).
Accuracy: 1 Year, 23°C ± 5°C, ±(ppmR + ppmFS):

10Ω Range:	18+2
100Ω to 100 kΩ Range:	10+0.5
1 MΩ Range:	15+1
10 MΩ Range:	30+5
100 MΩ Range:	400+50
1 GΩ Range:	0.3%+500

Open Circuit Voltage: <20V.
Lead Resistance: Up to 100Ω.
Current Through Unknown:

10Ω and 100Ω	10 mA
1 kΩ	1 mA
10 kΩ and 100 kΩ	100 µA
1 MΩ	10 µA
10 MΩ	1 µA
100 MΩ	100 nA
1 GΩ	10 nA

Input Protection: Withstands 250V RMS on any range.
Settling Time: Up to 100 kΩ generally the same as DCV.
Read Rate: 3/s at 7 1/2 digits, 1000/s at 5 1/2 digits

DC Current

Ranges: 100 µA to 1A in decades.
FS: 2 x Full Range. 100% Overrange.
Resolution: 100 pA, 6 1/2 digits.
Accuracy: 1 Year, 23°C ± 5°C, ±(ppmR + ppmFS):
100 µA to 10 mA Ranges: 50+2
100 mA Range: 100+5
1A Range: 150+10

AC Current

Ranges: 100 µA to 1A in decades.
FS: 2 x Full Range. 100% Overrange.
Resolution: 1 nA, 5 1/2 digits.
Accuracy: 1 Year, 23°C ± 5°C, ±(%R + %FS):
100 µA to 100 mA Range:

40 Hz-5 kHz	200+100

1A Range:

10 Hz-1 kHz	500+200
1-5 kHz	0.15%+0.04%

Frequency

Resolution: 4 1/2 or 6 1/2 digits.
Accuracy: (1 Year, 13°C to 33°C).
±10 ppmR+2 digits (6 1/2 digits, 10 Hz - 1 MHz).
±2 digits (4 1/2 digits, 200 Hz - 1 MHz).
Sample Interval:
Fast Gate 50 ms (4 1/2 digits).
Normal Gate 1s (6 1/2 digits)

Ratio Accuracy

±(net signal accuracy + net reference accuracy).

GENERAL

Calibration: Selfcal internal calibration. Autocal external calibration from front panel or via IEEE-488 interface.
Remote Programming: IEEE-488.2
Environmental:
Operating temp: 0°C to +50°C.
Storage temp: -40°C to +70°C.
Dimensions: 88 mm (3.5 in.) high, 427 mm (16.8 in.) wide, 487 mm (19.2 in.) deep.
Weight: 13.5 kg (30 lb).
Power: 100-130 Vac or 200-260 Vac, 47 Hz-63 Hz, 37VA.

OPTIONS

10: True RMS High Speed AC Converter
12: True RMS High Accuracy AC Converter
20: 2-Wire and 4-Wire Resistance Converter
30: Current Converter. (Only available with Option 20)
40: Comprehensive Ratio
70: Isolated Analog Output
80: 115V 60Hz Line Operation
81: 115V 50Hz Line Operation
90: Rack Mounting Kit
Model 1271MT:
as 1271 mainframe with MATE (CIIL) Interface & including options 12,20,30,40, & 70

ACCESSORIES

1501: DMM Lead Kit

FACTORY/FOB

Indianapolis, IN & Norwich, England

ORDER INFORMATION

Model 1271
8 1/2 Digit SELFCAL Digital Multimeter (Includes DCV, Rear Input, IEEE-488.2, 1 Year Warranty)
Option 10
Option 12
Option 20
Option 30
Option 40
Option 70
Option 80
Option 81
Option 90
Model 1271MT
Accessory 1501

Autocal Digital Multimeters

- **6 1/2 Digit Resolution**
- **90 Day DCV Specifications to ±28 ppm**
- **High Accuracy ACV Option**
- **IEEE-488 and MATE Models**
- **200 Readings/sec**

The 1061A/1062 series are accurate 6 1/2 digit DMMs optimized for systems applications, which also satisfy a wide range of bench and professional requirements.

Instrument Configurations
Maximum flexibility is assured by offering the 1061A as a DC voltmeter to which options may be added, giving it multifunction capability specific to the user's requirements. Optional functions include true rms ACV (normal or high accuracy versions), Resistance, Current, Ratio, and IEEE-488. The model 1062 is a fixed configuration version, featuring DCV, true rms ACV, Resistance, selectable rear inputs, and IEEE-488.

To fulfill MATE requirements, the 1062MT model offers DCV, true rms ACV, Resistance, selectable rear inputs and IEEE-488 as standard, and an optional Current converter furnishes DCI and ACI measurement capability. It provides the same specifications as the 1061A/1062, but for less stringent applications, a lower specified model, the 1062MT-5 is available.

Systems Capability
These DMMs when configured with an IEEE-488 interface are capable of meeting the most demanding systems applica-tions. With complete control available from the bus, and featuring a wide selection of SRQ and trigger modes, they can readily adapt to a wide variety of systems configurations. For the more exacting ATE applications, these DMMs provide an impressive selection of specialist features, including Ohms Guard for in-circuit resistance measurements, and excellent common mode and series mode rejection characteristics ensure that they maintain a high degree of measurement integrity under the most adverse conditions.

For users wishing to interface the 1061A into parallel BCD systems, a BCD Digital Interface can be fitted to a 5 1/2 digit version of the instrument known as the 1061. Full range and function programming is provided together with control of the DMM's triggering, while readings are output as BCD data together with full instrument status. With this interface fitted, the 1061 can achieve 30 readings per second with 5 1/2 digits resolution or up to 100 readings per second in 4 1/2 digit Superfast mode. In applications requiring more than one instrument on a common data bus, the BCD interface can be tri-stated to disconnect it from the system.

MATE Compatibility
The 1062MT is specifically designed for Modular Automated Test Equipment applications (MATE). Under the United States Air Force MATE System Control Interface Standard, this DMM is classed as a Sensor Module, type DMM, with a single measurement channel. The Control Interface Intermediate Language, CIIL, is used as the normal programming language, although native IEEE-488 bus commands may be used when required. The 1062-MT5 is a similar but less accurate version, please contact your Sales Office for specifications of this model.

High Reliability
In systems use, the high reliability and fast AUTOCAL features eliminate expensive downtime for repair and recalibration. In addition, an extensive diagnostic

self-check routine can be run on command to test measurement circuits, displays and the non-volatile calibration memory.

Computation

These DMMs are supplied with math functions which include offset and scaling, Max, Min, and Max-Min stores for capturing the largest excursions of a signal over a period of time, Hi and Lo limits for testing signals to predetermined limits, and dB conversion covering a dynamic range of ±200 dB to a resolution of 0.0001 dB.

DC Voltage

Ranges: 100 mV to 1000V in decades.
FS: 2 x Full Range. 100% Overrange. (Except 1 kV range).
Resolution: 100 nV, 6 1/2 digits.
Accuracy: 90 Days, 23°C ± 5°C, ±(ppmR + ppmFS):

100 mV Range:	30 + 8.
1V & 10V Ranges:	20 + 4.
100V Range:	30 + 4.
1000V Range:	30 + 4.

CMRR: (1kΩ unbalance) 140 dB at DC, >(80 dB + NMRR) at 1Hz - 60 Hz.
NMRR: 66 dB at 50/60 Hz (Filter out), 100 dB at 50/60 Hz (Filter in).
Input Impedance: >10,000 MΩ from 100 mV to 10V ranges, 10 MΩ ±0.1% on 100V and 1000V ranges.
Input Protection: Withstands 1kV RMS on any range.
Input Current: <50 pA.
Settling Time: (To 10 ppm step size) <5 ms (Filter out), <350 ms (Filter in).
Read Rate: 1.5/s at 6 1/2 digits, 200/s in Super-fast mode, 4 digits.

True RMS AC Voltage.
Ranges: 100 mV to 1000V in decades.
FS: 2 x Full Range. 100% Overrange. (Except 1kV range).
Resolution: 1 µV, 5 1/2 digits.
Accuracy: 90 Days, 23°C ± 5° C, Signal >0.25%FS, ±(%R + %FS):

100 mV and 1000V Ranges

45 Hz - 5 kHz:	0.08 + 0.02.
5 kHz - 100 kHz:	0.2 + 0.05.

1V to 100V Ranges

45 Hz - 5 kHz:	0.04 + 0.01.
5 kHz - 100 kHz:	0.1 + 0.025.

CMRR: (1kΩ unbalance) >90 dB at DC -60 Hz.
Input Impedance: >1 MΩ & 150 pF.
Input Protection: Withstands 1kV RMS on any range.
Crest factor: 7:1 at Full Range.
Max Volt-Hertz: 1 kV x 20 kHz.
Settling Time: (To 0.1% step size) <500 ms (Filter in), <150 ms (Filter out).
Read Rate: 3/s.

High Performance True RMS ACV

Resolution: 100 nV, 6 1/2 digits.
Accuracy: 90 Days, 23°C ± 5°C, Signal >1%FS, ±(%R + %FS):

100 mV and 1000V Ranges

45 Hz - 2 kHz:	0.04 + 0.007.
2 kHz - 30 kHz:	0.08 + 0.015.
30 kHz - 100 kHz:	0.2 + 0.022.

Add 0.01% per 100V above 500V.

1V to 100V Ranges

45 Hz - 2 kHz:	0.025 + 0.005.
2 kHz - 30 kHz:	0.05 + 0.01.
30 kHz - 100 kHz:	0.1 + 0.02.

Ranges, FS, CMRR, Input Impedance, Input Protection, Max Volt/Hertz:
All as Option 10.
Crest Factor: 5:1 at Full Range.
Settling Time: (To 0.1% step size) <200 ms (Filter out), <1.25 ms (Filter in).

Resistance

Ranges: 10Ω to 10 MΩ in decades.
FS: 2 x Full Range, 100% Overrange.
Resolution: 10 µΩ, 6 1/2 digits.
Accuracy: 90 Days, 23°C ± 5° C, ±(ppmR + ppmFS):

10Ω Range:	40 + 8.
100Ω to 10 kΩ Range:	30 + 4.
100 kΩ Range:	40 + 4.
1 MΩ Range:	100 + 4.
10 MΩ Range:	300 + 4.

Open Circuit Voltage: <10V.
4-wire Lead Resistance: Up to 100Ω.
Current Through Unknown:

10Ω	10 mA
100Ω	10 mA
1 kΩ	1 mA
10 kΩ	100 µA
100 kΩ	10 µA
1 µΩ	1 µA
10 MΩ	100 nA

Input Protection: Withstands 250V RMS on any range.
Settling Time: Up to 10 kΩ generally the same as DCV.
Read Rate: As DCV.

DC Current

Ranges: 100 µA to 1A in decades.
FS: 2 x Full Range. 100% Overrange.
Resolution: 1 nA, 5 1/2 digits.
Accuracy: 90 Days, 23°C ± 5°C, ±(ppmR + ppmFS):
100 µA to 100 mA Ranges: 100 + 20.
1A Range: 200 + 20.
Shunt Resistance:

100 µA	1kΩ
1 mA	100Ω
10 mA	10Ω
100 mA	1Ω
1A	100 mΩ

Settling Time: (To 10 ppm of step size) <5 ms (Filter out), <350 ms (Filter in).
Read Rate: as DCV.

AC Current

Ranges: 100 µA to 1A in decades.
FS: 2 x Full Range. 100% Overrange.
Resolution: 1nA, 5 1/2 digits.
Accuracy: 90 Days, 23°C ± 5°C, ±(%R + %FS):
100µA to 1A Ranges:

45 Hz - 5 kHz	0.2 + 0.05

Shunt Resistance: as DCI.
Settling Time: (To 0.1% of step size) <150 ms (Filter out), <500 ms (Filter in).
Read Rate: As ACV.
Ratio Accuracy:
±(net signal accuracy + net reference accuracy).

GENERAL

Calibration: Autocal from front panel or via the IEEE-488 interface.
Remote Programming:
IEEE-488, MATE on MT models.
BCD (1061 Only)
Environmental:
Operating Temp: 0°C to +50°C.
Storage Temp: -40°C to +70°C.
Dimensions: 88 mm (3.5 in.) high, 455 mm (17.9 in.) wide, 420 mm (16.5 in.) deep.
Weight: 10 kg (22 lb.).
Power: 105-127 Vac or 205-255 Vac, 50 Hz, 60 Hz, or 400 Hz. 20 Watts approx.

CONFIGURATIONS

Model 1061A: 6 1/2 Digit AUTOCAL Digital Multimeter (includes DCV, 5 Year Warranty).
Model 1061: 5 1/2 Digit AUTOCAL Digital Multimeter (includes DCV, 5 Year Warranty).
Model 1062: (U.S. only) 6 1/2 Digit AUTOCAL Digital Multimeter (includes DCV, ACV, Resistance, rear input, IEEE-488, 1 Year Warranty).
Model 1062/12: (U.S. only) 6 1/2 Digit AUTOCAL Digital Multimeter (includes DCV, High Performance ACV, Resistance, rear input, IEEE-488, 1 Year Warranty).
Model 1062-MT: as 1062 with MATE interface.
Model 1062-MT5: contact Sales Office.

OPTIONS

10: True RMS AC Converter
12: High Performance True RMS AC Converter
20: 2-wire and 4-wire Resistance Converter
30: Current Converter (Not available with Option 12)
40: Comprehensive Ratio and Rear Input
41: Selectable Rear Input (Included with Option 40)
50: IEEE-488 (1978) Standard Digital Interface
51: BCD Digital Interface (1061 only. Not available with Option 50)
52: Remote Trigger (Included in Option 50)
70: Analog Output
80: 115V 60 Hz Line Operation
81: 115V 50 Hz Line Operation
82: 115V 400 Hz Line Operation
90: Rack Mounting Kit

ACCESSORIES

1501: DMM Lead Kit

FACTORY/FOB

Indianapolis, IN & Norwich, England

ORDER INFORMATION

Model 1061A
Model 1061
Model 1062
Model 1062/12
Model 1062MT
Option 10
Option 12
Option 20
Option 30
Option 40
Option 41
Option 50
Option 51
Option 52
Option 70
Option 80
Option 81
Option 82
Option 90
Accessory 1501

Calibrators

The Datron Instruments Autocal family of calibrators and automated calibration systems leads the world in innovative calibration technology, providing an unparalleled choice of functional capability and performance. Together with Datron's calibration software, controllers, accessories and support products, the Autocal range offers a selection of high quality instruments and systems with a variety of different specifications and costs. From this range, the optimum solution can be found to most digital multimeter (DMM) calibration requirements, together with high accuracy system source and DC to Low Frequency Standards applications. Datron calibrator performances vary from the Standards Laboratory accuracy of a multifunction calibrator capable of calibrating today's highly accurate 7 1/2 and 8 1/2 digit DMMs, to one similar in appearance and functionality, but with a performance and price which is ideally suited to handheld and 3 1/2 and 4 1/2 digit DMM calibration requirements. Functionally, the number of options within the complete calibrator range is virtually limitless, varying from dedicated DCV-only or ACV-only units, suitable for standards laboratory or systems use, to calibrators which are fully multifunction: single instruments with the flexibility of functions and the breadth of range in both amplitude and frequency to fulfill the ever more stringent demands of the modern calibration facility. Practical and straightforward to use on the bench, all Datron Autocal calibrators are fully programmable via the IEEE-488 interface, making them excellent sources for automated calibration systems. In addition, the wide temperature tolerance of these instruments extends their usefulness to many A.T.E. or systems applications outside the calibration laboratory, for example, on the production floor or in the factory test bay. Datron Calibration Software is available to enhance these features, offering a range of fully integrated, menu driven, automated multimeter calibration systems either for use in the traditional calibration environments, or for more demanding mobile calibration roles. A superb range of complementary DC Standards equipment provides users with levels of accuracy, traceability and reliability which meet the most demanding calibration requirements.

BENCHTOP CALIBRATION SYSTEMS

Software	Calibrator	Controller	Printer	Analog Leads	IEEE Leads	Pg.	
4101B	4708, 4700, 4705	IBM-XT, HP Vectra (4103A) or Compaq (4103B)	4104	PLK-2	2	155	
4101B	4708, 4700, 4705 with 4600 amplifier	IBM-XT, HP Vectra (4103A) or Compaq (4103B)	4104	PLK-2 440151 440154	2	155	

Note: Printer includes printer interface cable

CALIBRATION SUPPORT PRODUCTS

Model No.	Description	pg.	
4901 Calibration Bridge and Lead Compensator	Calibrates each section of the divider to the very highest precision, using ratio techniques approved by National Standards authorities.	157	
4902S Reference Divider	True 4 wire, 5 terminal resistive divider capable of providing 10:1 and 100:1 ratio accuracies, with a 100V or 1000V input, to within 0.2 ppm.	157	
4904 Standard Cell Buffer	Low noise, low drift unity gain amplifier, with four wire remote sensing to drive Kelvin-Varley type dividers, featuring full protection for the Standard Cell.	157	
4910 DC Voltage Reference Standard	Four independent 10V output 'cells' in one unit, each adjustable to <0.1 ppm resolution. Four wire sensed buffer, and adjustable outputs at the 1.018V and 1V levels.	156	
4911 DC Voltage Reference Standard	As for 4910 but excluding the four wire buffer and 1.018, 1V outputs.	156	

PROGRAMMABLE CALIBRATORS SELECTION GUIDE

Model No.	Basic Functions	Optional Functions	Display Resolution	Ranges	Basic Accuracy 90 day, ±1°C ±(ppmR + ppmFS)	Frequency Span	Comments	Pg.	
4708	Fully configurable: IEEE-488	DCV, ACV, DCI, ACI and Ω	7 1/2 6 1/2	DCV: 100 µV-1 kV ACV: 1 mV-1 kV DCI: 100 µA-1A ACI: 100 µA-1A Ω: 10Ω-100 MΩ	1 + 0.15 30 + 5 20 + 5 70 + 30 3	10 Hz-1 MHz 10 Hz-5 kHz	For calibration of up to 8 1/2 digit DMMs 4101B compatible 4600 compatible	140	
4700	DCV & ACV to 200V, IEEE-488	1kV ranges DCI, ACI and Ω	7 1/2 6 1/2	DCV: 100 µV-1 kV ACV: 1 mV-1 kV DCI: 100 µA-1A ACI: 100 µA-1A Ω: 10Ω-100 MΩ	4 + 0.5 120 + 20 40 + 7 220 + 80 6	10 Hz-1 MHz 10 Hz-5 kHz	For calibration of up to 6 1/2 DMMs digit 4101B compatible 4600 compatible	142	
4705	DCV, ACV, DCI, ACI, Ω, IEEE-488	None	6 1/2 5 1/2	DCV: 100 µV-1 kV ACV: 1 mV-1 kV DCI: 100 µA-1A ACI: 100 µA-1A Ω: 10Ω-100 MΩ	15 + 1 250 + 50 50 + 15 220 + 80 6	10 Hz-100 kHz 10 Hz-5 kHz	For calibration of up 5 1/2 digit DMMs 4101B compatible 4600 compatible	144	
4600	DCI, ACI	None	-	DCI: 0-11A ACI: 90 mA-11A	50 + 25 200 + 55	10 Hz-20 kHz	Transconductance amp for high currents	146	

Multifunction Standard

- **DCV, ACV, DCI, ACI and Ω Functions**
- **True 1kV AC Performance from a Single Unit**
- **Configurable to Meet Individual Requirements**
- **IEEE-488, Autocal, 4101B and 4600 Compatible**
- **Calibrates DMMs of up to 8 1/2 Digit Scale Length**

The model 4708 Autocal Multifunction Standard offers the very best in programmable multifunction performance. Capable of calibrating—BY ITSELF—the latest generation of high performance systems and standards DMMs, it represents the most practical and cost-effective solution to today's high accuracy calibration requirements.

DC Voltage
With outputs available from 10 nV to 1100V, and 90 day, ±1°C specifications to 1 ppm, the DC Voltage function offers performance unrivalled by any other instrument. This performance extends to high linearity and low noise, essential when calibrating 7 1/2 and 8 1/2 digit DMMs, while the fast settling times inherent in the signal generation techniques employed make the instrument ideal for automated applications.

AC Voltage
The AC Voltage function also offers unmatched performance and functional capability, offering 90 day, ±1°C specifications to 30 ppm with 65 mA of current drive available on the 1000V range. In practice this means that the high voltage-high frequency test requirements of today's DMMs may be met by one single, compact unit, the 4708 driving up to 750V at 100 kHz.

A 'Spot' frequency calibration feature can be used to eliminate the flatness component of the accuracy specification, providing enhanced accuracy at up to five user selected frequency points per range, for both ACV and ACI functions.

The internal AC-DC transfer is accomplished by a fully electronic technique, which offers faster settling times than traditional thermal techniques. These settling times are also independent of signal level, a most desirable feature in automated applications.

Resistance and Current
Fully floating, high accuracy DC and AC currents are generated using a voltage to current converter which incorporates specially developed low loss shunts and is driven from either the DCV or ACV sections of the calibrator. For applications that require higher currents, such as the calibration of handheld multimeters, the model 4600 Transconductance Amplifier extends the current function to 11A. Resistance outputs are derived from eight fixed value, hermetically sealed standard resistors, each being 4-wire or 2-wire connected to the output terminals, using ultra high isolation relay switches.

Flexibility and Ease of Use
The IEEE-488 interface is fitted as standard, enabling the 4708 to form the heart of a compact and highly accurate calibration or test system, while its rugged construction and insensitivity to temperature variations make it ideal for

applications outside of the traditional calibration environment. It is compatible with the Datron 4101B Multimeter Calibration software package, a combination which forms an automated calibration system capable of calibrating anything from simple handheld multimeters up to the most sophisticated Standards DMMs.

Calibration

The Model 4708 employs Autocal, the electronic adjustment technique whereby all calibration adjustments are made through the use of digital corrections stored in non-volatile memory. The instrument is calibrated by applying the standard and following a simple sequence of front panel keystrokes or IEEE-488 bus commands. Moreover, the signal generation circuit configuration employed during calibration is the same as that used during normal operation, ensuring fast, traceable, repeatable calibration.

SPECIFICATIONS

DC Voltage (Option 10)

Ranges: 100 µV to 1000V in decades.
Full scale: 2 x range except 1000V range, where max output is 1100V.
Resolution: 1 digit in 19,999,999 or 10 nV, whichever is greater.
Accuracy: 90 days, 23°C ±1°C: ±(ppm Output + ppmFS)

100 µV to 100 mV Ranges: 3 + 0.4 µV

1V Range:	2 + 0.4
10V Range:	1 + 0.15
100V Range:	2 + 0.25
1000V Range:	3 + 0.25

Sensing: Selectable remote/local sensing on 1V to 1000V ranges.
Guarding: Selectable remote/local guarding.
Settling Time: <1 s to 10 ppm of step size.
Output Impedance/Max Output Current:
100 µV to 100 mV Ranges: 100Ω.
1V to 1000V Ranges: 25 mA max.

AC Voltage (Option 20)

Ranges: 1 mV to 1000V in decades.
Full Scale: 2 x range except 1000V range, where max output is 1100V.
Resolution: 1 digit in 1,999,999 or 100 nV, whichever is greater.
Frequency: Ranges: 100 Hz to 1 MHz in decade steps. Resolution: 1% of range. Accuracy: <±100 ppm.
Sensing: Selectable remote/local sensing on 1V to 1000V ranges.
Guarding: Selectable remote/local guarding.
Maximum Capacitive load: 1000 pF on 1V to 100V ranges, 300 pF on 1000V range.
Wideband Accuracy: 90 days, 23°C ± 1°C: ±(ppm Output + ppmFS)

1 mV to 100 mV Ranges

110 + 20 + 5 µV:	(10 - 31 Hz)
60 + 20 + 5 µV:	(32 - 330 Hz)
50 + 20 + 5 µV:	(300 Hz - 10 kHz)
60 + 20 + 5 µV:	(10k - 33 kHz)
250 + 20 + 5 µV:	(30k - 100 kHz)
750 + 50 + 10 µV:	(100k - 330 kHz)
1550 + 500 + 20 µV:	(300k - 1 MHz)

1V and 10V Ranges

80 + 15:	(10 - 31 Hz)
40 + 10:	(32 - 330 Hz)
30 + 5:	(300 Hz - 33 kHz)
60 + 10:	(30k - 100 kHz)
180 + 50:	(100k - 330 kHz)
1100 + 200:	(300k - 1 MHz)

100V Range

90 + 15:	(10 - 31 Hz)
50 + 10:	(32 - 330 Hz)
40 + 5:	(300 Hz - 10 kHz)
50 + 10:	(10k - 33k Hz)
90 + 15:	(30k - 100 kHz)
280 + 50:	(100k - 200 kHz)

1000V Range

130 + 10:	(45 - 330 Hz)
90 + 10:	(300Hz - 10 kHz)
130 + 10:	(10k - 33 kHz)
750 + 20:	(750V max, 30k - 100 kHz)

Settling Times: To 100 ppm of step size: <10s (10-32 Hz), <3 s (33-330 Hz), <1 s (>330 Hz).

DC Current (Option 30)

Ranges: 100 µA to 1A in decades.
Full scale: 2 x range.
Resolution: 1 digit in 1,999,999 or 100 pA, whichever is greater.
Accuracy: 90 days, 23°C ± 1°C: ±(ppm Output + ppmFS)

100 µA Range:	50 + 10
1 mA Range:	20 + 5
10 mA Range:	20 + 5
100 mA Range:	20 + 5
1A Range:	50 + 10
10A Range (Requires Model 4600):	50 + 25

Guarding: Selectable remote/local guarding.

AC Current (Option 30)

Ranges: 100 mA to 1A in decades.
Full Scale: 2 x range.
Resolution: 1 digit in 1,999,999 or 100 pA, whichever is greater.
Accuracy: 90 days, 23°C ± 1°C: ±(ppm Output + ppmFS).

100 µA Range

120 + 30:	(10 Hz - 1 kHz)
250 + 40:	(1 k - 5 kHz)

1 mA Range

70 + 30:	(10 Hz - 1 kHz)
120 + 30:	(1k - 5 kHz)

10 mA Range

70 + 30:	(10 Hz - 1 kHz)
120 + 30:	(1k - 5 kHz)

100 mA Range

70 + 30:	(10 Hz - 1 kHz)
120 + 30:	(1k - 5 kHz)

1A Range

250 + 30:	(10 Hz - 1 kHz)
400 + 40:	(1k - 5 kHz)

10A Range (Requires Model 4600):

280 + 70:	(10 Hz - 1 kHz)
730 + 75:	(1k - 5 kHz)

Guarding: Selectable remote/local guarding.

Resistance (Option 30)

Ranges: 10Ω to 100 MΩ in decades. (Ranges are nominal, actual calibrated values are displayed).
Connections: Selectable 2 or 4-wire, remote/local guard.
Display Resolution: 1 digit in 19,999,999.
Accuracy: 90 days, 23°C ± 1°C: ±(ppm Output):

10Ω:	10
100Ω, 1 kΩ, 10 kΩ, 100 kΩ:	3
1 MΩ:	10
10 MΩ:	25
100 MΩ:	30

GENERAL

Calibration: Autocal from front panel or via the IEEE-488 interface.
Environmental:
Operating Temp: 0°C to +50°C.
Storage Temp: -40°C to +70°C.
Dimensions: 178 mm (7 in.) high; 455 mm (17.9 in.) wide; 563 mm (22.2 in.) deep.
Weight: 36 kg (80 lb.) net.
Power: 100/120/220/240 Vac ±10%, 50 Hz or 60 Hz. Consumption 370 VA standby, 660 VA full power.

OPTIONS

10: DCV Ranges.
20: ACV Ranges.
30: DCI, ACI and Resistance Ranges (requires Option 10, or 20, or both).
42: Alternative Rear Output.
80: 115V 60Hz line operation.
81: 115V 50Hz line operation.
90: Rack Mounting Ki'

FACTORY/FOB

Indianapolis, IN & Norwich, England

ORDER INFORMATION

Model 4708
Option 10
Option 20
Option 30
Option 42
Option 80
Option 81
Option 90

Multifunction Calibrator

- **DCV, ACV, DCI, ACI and Ω Functions**
- **True 1kV AC Performance from a Single Unit**
- **Configurable to Meet Individual Requirements**
- **IEEE-488, Autocal, 4101B and 4600 Compatible**
- **Calibrates DMMs of up to 6 1/2 Digit Scale Length**

Over 90% of the typical calibration facility DMM workload consists of a range of instruments varying in performance and capabilities from simple handheld multimeters to the latest generation of mid-performance 5 1/2 and 6 1/2 digit systems DMMs. For these instruments, the model 4700 offers the most cost-effective calibration solution available, providing the necessary performance at an economic price.

DC and AC Voltage

The standard instrument will source DC voltages from 10 nV to 200V with 90 day, ±1°C specifications to 4 ppm, which provides a sufficient margin of accuracy over the latest generation of mid-performance half and full rack systems DMMs. With AC voltages from 90 mV to 200V to within 120 ppm, the 4700 is capable of calibrating all but the most accurate AC-measuring meters. The output capability of both functions may be extended to 1100V by the high voltage option. This is resident within the calibrator which is then capable of sourcing, from a single, compact unit, the high voltage-high frequency test points required by today's systems DMMs.

Resistance and Current

Fully floating, high accuracy DC and AC currents are generated using a voltage to current converter which incorporates specially developed low loss shunts and is driven from either the DCV or ACV sections of the calibrator. For applications that require higher currents, such as the calibration of handheld multimeters, the model 4600 Transconductance Amplifier extends the current functions to 11A. Resistance outputs are derived from eight fixed value, hermetically sealed standard resistors, each being 4-wire or 2-wire connected to the output terminals, using ultra high isolation relay switches.

Flexibility and Ease of Use

A major design objective of the 4700 was to make it simple and straightforward to operate. Rapid rolling up/down keys are used for fast and easy setting of amplitude and frequency. The selected output is displayed on a high brightness display, while the patented spec. readout feature eliminates the need to make complex and tedious calculations of the accuracy of the applied signal. Deviation controls—Error and Offset—enable the output of the calibrator to be varied from that indicated on the main output display, useful for checking the linearity and calibration of measuring instruments.

The 4700 is not limited to applications inside the calibration laboratory. Its rugged construction and insensitivity to temperature variations (specifications are available for 23°C ± 10°C operation) mean that the instrument is equally suited to applications outside of the traditional calibration environment. As an accurate test source or stimulus, the 4700 provides a highly cost effective solution to meet the growing requirements in A.T.E.s for improved test accuracy and confidence. For example, the basic 4700—without any options—can

be installed as an integral source within an ATE rack to provide accurate, stable, programmable DC and AC voltages up to 200V.

In addition, the instrument is compatible with the Datron 4101B Multimeter Calibration software package. Together, the 4700 (optionally configured with the model 4600) and 4101B can form the basis of a compact, rugged and highly versatile automated calibration system capable of calibrating any multimeter from simple handhelds up to 5 1/2 and 6 1/2 digit systems DMMs.

SPECIFICATIONS

DC Voltage

Ranges: 100 µV to 1000V in decades.
Full scale: 2 x range except 1000V range, where max output is 1100V.
Resolution: 1 digit in 19,999,999 or 10 nV, whichever is greater.
Accuracy: 90 days, 23°C ±1°C: ±(ppm Output + ppmFS)

100 µV to 100 mV Ranges:	6 + 0.8 µV
1V Range:	6 + 0.8
10V Range:	4 + 0.5
100V Range:	6 + 1.0
1000V Range (Option 10):	6 + 0.5

Sensing: Selectable remote/local sensing on 1V to 1000V ranges.
Guarding: Selectable remote/local guarding.
Settling Time: <1s to 10 ppm of step size.
Output Impedance/Max output current: 100 µV to 100 mV ranges: 100Ω.
1V to 1000V range: 25 mA max.

AC Voltage

Ranges: 1 mV to 1000V in decades.
Full scale: 2 x range except 1000V range, where max output is 1100V.
Resolution: 1 digit in 1,999,999 or 100 nV, whichever is greater.
Frequency: Ranges: 100 Hz to 1 MHz in decade steps. Resolution: 1% of range. Accuracy: <±100 ppm.
Sensing: Selectable remote/local sensing on 1V to 1000V ranges.
Guarding: Selectable remote/local guarding.
Maximum Capacitive Load: 1000 pF on 1V to 100V ranges, 300 pF on 1000V range.
Accuracy: 90 days, 23°C ± 1°C: ±(ppm Output + ppmFS)

1 mV to 100 mV Ranges

10 to 31 Hz:	250 + 60 + 10 µV
32 Hz to 33 kHz:	200 + 40 + 10 µV
30k to 100 kHz:	600 + 60 + 10 µV
100k to 330 kHz:	0.2% + 0.02% + 20 µV
300k to 1 MHz:	0.6% + 0.2% + 30 µV

1V and 10V Ranges

10 to 31 Hz:	200 + 40
32 Hz to 33 kHz:	120 + 20
30k to 100 kHz:	200 + 30
100k to 330 kHz:	600 + 200
300k to 1 MHz:	0.4% + 0.1%

100V Range

10 to 31 Hz:	200 + 40
32 Hz to 33 kHz:	120 + 20
30k to 100 kHz:	250 + 40

1000V Range (Option 10)

45 to 330 Hz:	200 + 50
300 Hz to 10 kHz:	150 + 50
10k to 33 kHz:	250 + 50

Settling times: To 100ppm of step size.

10 to 32 Hz:	<10s
33 to 330 Hz:	<3s
>330 Hz:	<1s

DC Current (Option 20)
Ranges: 100 µA to 1A in decades.
Full scale: 2 x range.
Resolution: 1 digit in 1,999,999 or 100pA, whichever is greater.
Accuracy: 90 days, 23°C ±1°C: ±(ppm Output + ppmFS)

100 µA Range:	50 + 10
1 mA Range:	40 + 7
10 mA Range:	40 + 7
100 mA Range:	40 + 7
1A Range:	100 + 15
10A Range: (Requires Model 4600):	60 + 25

Guarding: Selectable remote/local guarding.

AC Current (Option 20)
Ranges: 100 µA to 1A in decades.
Full scale: 2 x range.
Resolution: 1 digit in 1,999,999 or 100 pA, whichever is greater.
Accuracy: 90 days, 23°C ± 1°C: ±(ppm Output + ppmFS)

100 µA Range

10 Hz to 1 kHz:	400 + 80
1k to 5 kHz:	550 + 100

1 mA Range

10 Hz to 1 kHz:	220 + 80
1k to 5 kHz:	350 + 80

10 mA Range

10 Hz to 1 kHz:	220 + 80
1k to 5 kHz:	350 + 80

100 mA Range

10 Hz to 1 kHz:	220 + 80
1k to 5 kHz:	350 + 80

1A Range

10 Hz to 1 kHz:	400 + 80
1k to 5 kHz:	550 + 100

10A Range: (Requires Model 4600):

10 Hz to 1 kHz:	400 + 95
1k to 5 kHz:	820 + 90

Guarding: Selectable remote/local guarding.

Resistance (Option 20)
Ranges: 10Ω to 100 MΩ in decades (Ranges are nominal, actual calibrated values are displayed).
Connections: Selectable 2 or 4-wire, remote/local guard.
Display resolution: 1 digit in 19,999,999.
Accuracy: 90 days, 23°C ± 1°C: ±(ppm Output):

10Ω:	20
100Ω, 1 kΩ, 10 kΩ, 100 kΩ:	6
1MΩ:	20
10MΩ:	50
100MΩ:	100

GENERAL
Calibration: Autocal from front panel or via the IEEE-488 interface.
Environmental
Operating Temp: 0° to +50°C.
Storage Temp: -40°C to +70°C.
Dimensions: 178 mm (7 in.) high, 455 mm (17.9 in.) wide, 563 mm (22.2 in.) deep.
Weight: 36 kg (80 lb).
Power: 100/120/220/240 Vac ±10%, 50 Hz or 60 Hz. Consumption 370 VA standby, 660 VA full power.

OPTIONS
10: 1000V Ranges for DCV and ACV
20: DCI, ACI and Ω
42: Alternative Rear Output
80: 115V 60Hz line operation.
81: 115V 50Hz line operation.
90: Rack Mounting Kit

FACTORY/FOB
Indianapolis, IN & Norwich, England

ORDER INFORMATION
Model 4700
Option 10
Option 20
Option 42
Option 80
Option 81
Option 90

Multifunction Calibrator

- **DCV, ACV, DCI, ACI and Ω Functions as Standard**
- **ACV Output from 10 Hz to 100 kHz**
- **True 1kV AC Performance from a Single Unit**
- **IEEE-488, Autocal, 4101B and 4600 Compatible**
- **Calibrates DMMs of up to 5 1/2 Digit Scale Length**

The model 4705 is a low cost, fully multifunction, programmable calibrator which has all functions fitted as standard. It is designed to calibrate DMMs of up to 5 1/2 digit scale length without the addition of external performance enhancement techniques, such as the use of a standards DMM to monitor the output.

An IEEE-488 interface is fitted as standard, so the unit can readily be integrated into a cost effective automated calibration system. Furthermore, its rugged construction makes it ideal for applications outside of the calibration laboratory, while its insensitivity to temperature variations ensures that a minimal loss of accuracy is experienced when the unit is installed in an A.T.E. rack.

DC and AC Voltage
The 4705 is capable of sourcing continuously variable DC voltages from 100 nV to 1100V with 90 day, ±1°C specifications to 15 ppm, and so has a comfortable margin of calibration accuracy over those 5 1/2 digit DMMs and below that constitute 80% of the typical calibration laboratory DMM workload. The outputs are truly bipolar, which removes the need for an operator to change test lead connections when a change of polarity is required.

AC voltages are available from 90 mV to 1100V, at frequencies continuously variable between 10 Hz and 100 kHz, with 90 day, ±1°C specifications to 250 ppm. The solid state 1000V range drive circuitry is integral to the unit, and is able to drive a capacitive load of 300 pF. This means that all of the high voltage-high frequency test points required by today's 4 1/2 to 5 1/2 digit bench and lower performance systems instruments may be sourced by a single, compact unit.

Resistance and Current
The 4705 will source continuously variable DC and AC currents to 2A, with 90 day, ±1°C specifications to 50 ppm and 220 ppm respectively. For applications that require higher currents, such as calibration of handheld multimeters, the model 4600 Transconductance Amplifier extends the current function to 11A. The resistance function makes resistances between 10Ω and 100 MΩ available, in both 2 and 4-wire configurations, with 90 day, ±1°C specifications to 6ppm.

Flexibility and Ease of Use
A major design objective of the 4705 was to make it simple and straightforward to operate. Rapid rolling up/down keys are used for fast and easy setting of amplitude and frequency. The selected output is displayed on a high brightness display, while the patented spec. readout feature eliminates the need to make complex and tedious calculations of the accuracy of the applied signal. Deviation controls—Error and Offset—enable the output of the calibrator to be varied from that indicated on the main output display, useful for checking the linearity and calibration of measuring instruments.

In addition, the instrument is compatible with the Datron 4101B Multimeter Calibration soft-ware package. Together, the 4705 (optionally configured with the model 4600) and 4101B can form the basis of a compact, rugged, cost-effective and highly versatile automated calibration system capable of calibrating any multimeter from simple handhelds up to 5 1/2 digit systems DMMs.

SPECIFICATIONS

DC Voltage

Ranges: 100 µV to 1000V in decades.
Full scale: 2 x range except 1000V range, where max output is 1100V.
Resolution: 1 digit in 1,999,999 or 100 nV, whichever is greater.
Accuracy: 90 day, 23°C ± 1°C: ±(ppm Output + ppmFS)

100 mV to 100 mV Ranges:	15 + 1 µV
1V Range:	15 + 1
10V Range:	15 + 1
100V Range:	15 + 1
1000V Range:	15 + 1

Sensing: Selectable remote/local sensing on 1V to 1000V ranges.
Guarding: Selectable remote/local guarding.
Settling Time: <1s to 10 ppm of step size.
Output Impedance/Max output current:
100 mV to 100 mV ranges: 100Ω .
1V to 1000V ranges: 25 mA max.

AC Voltage

Ranges: 1 mV to 1000V in decades.
Full scale: 2 x range except 1000V range, where max output is 1100V.
Resolution: 1 digit in 199,999 or 1 µV, whichever is greater.
Frequency: Ranges: 100 Hz to 1 MHz in decade steps. Resolution: 1% of range. Accuracy: <±100 ppm.
Sensing: Selectable remote/local sensing on 1V to 1000V ranges.
Guarding: Selectable remote/local guarding.
Maximum Capacitive load: 1000 VpF on 1V to 100V ranges, 300 VpF on 1000V range.
Accuracy: 90 day, 23°C ± 1°C: ±(ppm Output + ppmFS)

1 mV to 100 mV Ranges:

300 + 60 + 10 µV	(10 - 31 Hz)
250 + 60 + 10 µV	(32 Hz - 33 kHz)
800 + 80 + 10 µV	(30k - 100 kHz)

1V, 10V, 100V Ranges:

300 + 60	(10 - 31 Hz)
250 + 50	(32 Hz - 33 kHz)
300 + 80	(30k - 100 kHz)

1000V Range:

300 + 60	(45 - 330 Hz)
250 + 50	(300 - 10 kHz)
300 + 80	(10k - 33 kHz)

Settling times: to 100 ppm of step size: <10s (10-32 Hz), <3s (33-330 Hz), <1s (>330 Hz).

DC Current

Ranges: 100 mA to 1A in decades.
Full scale: 2 x range.
Resolution: 1 digit in 199,999 or 1 nA, whichever is greater.
Accuracy: 90 days, 23°C ± 1°C: ±(ppm Output + ppmFS)

100 µA, 1 mA, 10 mA and 100 mA Ranges:	50 + 15
1A Range:	115 + 20
10A Range (Requires Model 4600):	65 + 25

Guarding: Selectable remote/local guarding.

AC Current

Ranges: 100 µA to 1A in decades.
Full scale: 2 x range.
Resolution: 1 digit in 199,999 or 1 nA, whichever is greater.
Accuracy: 90 days, 23°C ± 1°C: ±(ppm Output + ppmFS)

100 µA Range:

400 + 80	(10 Hz - 1 kHz)
550 + 100	(1k - 5 kHz)

1 mA, 10 mA and 100 mA Ranges:

220 + 80	(10 Hz - 1 kHz)
350 + 80	(1k - 5 kHz)

1A Range:

400 + 80	(10 Hz - 1 kHz)
550 + 100	(1k - 5 kHz)

10A Range: (Requires Model 4600)

500 + 115	(10Hz - 1 kHz)
950 + 120	(1k -5 kHz)

Guarding: Selectable remote/local guarding.

Resistance

Ranges: 10Ω to 100 MΩ in decades (Ranges are nominal, actual calibrated values are displayed).
Connections: Selectable 2 or 4-wire, remote/local guard.
Display resolution: 1 digit in 1,999,999.
Accuracy: 90 days, 23°C ± 1°C: ±ppm Output:

10Ω	30
100Ω, 1 kΩ, 10 kΩ & 100 kΩ	6
1MΩ	25
10MΩ	100
100MΩ	125

GENERAL

Calibration: Autocal from front panel or via the IEEE-488 interface
Environmental:
Operating temp: 0°C to +50°C.
Storage temp: -40°C to +70°C.
Dimensions: 178 mm (7 in.) high; 455 mm (17.9 in.) wide; 563 mm (22.2 in.) deep.
Weight: 36 kg (80 lb).
Power: 100/120/220/240 Vac ±10%, 50 Hz or 60 Hz. Consumption 370 VA standby, 660 VA full power.

OPTIONS

42: Alternative Rear Output
80: 115V 60 Hz Line Operation
81: 115V 50 Hz Line Operation
90: Rack Mounting Kit

FACTORY/FOB
Indianapolis, IN & Norwich, England

ORDER INFORMATION
Model 4705
Option 42
Option 80
Option 81
Option 90

Transconductance Amplifier

- **Extends Calibrator Currents to 11A DC & AC rms**
- **Slave Mode Programmable from 4708, 4700 &4705**
- **Solo Mode Operation for General Application**
- **AC Performance from 10 Hz to 20 kHz**

A significant proportion of lower performance bench and handheld DMMs are capable of measuring currents of 10A or more. In the interests of traceability and operator safety, these instruments require calibration at these higher current levels. The model 4600 Transconductance Amplifier provides a rugged, compact solution, capable of extending the current sourcing capabilities of Datron Calibrators to 11A DC or rms AC, and may also be used with other suitable voltage sources. When used with a compatible model 4708, 4700 or 4705, it provides a fully integrated solution, being transparently controlled by the calibrator.

Solo Mode

Working on the principle of converting a voltage input to a current output, the 4600 has a transfer characteristic of 1 Amp per Volt for both DC and AC, and may be coupled to any appropriate voltage source. With 90 day, ±1°C specifications of the order of 100 ppm for DC currents and 300ppm for AC, a sufficient margin of calibration accuracy is assured over the performance of bench and handheld DMMs.

Slave Mode

When used with a compatible model 4708, 4700 or 4705, two cables connect the Transconductance Amplifier to the Calibrator. The first is fully shielded and carries the analog voltage from the rear panel of the Calibrator to the 4600's rear panel, while a digital cable carries control signals between them. The 10A range of the Calibrator is automatically enabled when the 4600 is present, and the user is then able to program the required current output from the Calibrator's front panel, or remotely via its IEEE-488 interface.

Calibration

For use in the solo mode, where the Calibrator has no control over the amplifier, there are a series of easily accessible trimpots to allow periodic recalibration of the 4600's circuitry. The slave mode, however, eliminates the need for any mechanical adjustments during the recalibration process, as it utilizes the Autocal technique resident within Datron Calibrators.

SPECIFICATIONS

DC CURRENT

Accuracy Relative to Voltage Source:
90 days, 23°C ± 1°C:
±(50 ppm Output + 500 µA).
Temperature Coefficient (23°C ± 10°C):
7 ppm/°C.
Compliance: >2V.

AC CURRENT

Accuracy Relative to Voltage Source:
90 days, 23°C ± 1°C:
10 Hz - 1 kHz: ±(200 ppm Output + 1.1 mA)
1 kHz - 5 kHz: ±(700 ppm Output + 1.4 mA)
5 kHz - 10 kHz: ±(1400 ppm Output + 6 mA)
10 kHz - 20 kHz: ±(0.54% Output + 33 mA)
Temperature Coefficient (23°C ± 10°C):
< 5 kHz: 10 ppm/°C; >5 kHz: 50 ppm/°C
Total Harmonic Distortion:
0.1% (10 Hz-1 kHz); 0.5% (1k-5 kHz);
1.0% (5k-10 kHz); 1.5% (10k-20 kHz).
Compliance: >2Vrms.
Scale Length: 9% to 110% of range.

GENERAL

Compatibility: Slave Mode compatible with all 4700 series calibrators equipped with firmware of issue 5.0 and above.
Input Impedance: 300 kΩ & 100 pF.
Isolation: 100V pk, I- to Chassis.
Output Protection: Fully protected against open circuit outputs.
Input Protection: 1.1kV DC or rms AC (10 sec), 240V DC or rms AC (continuous).
Calibration: Trimpots (Solo mode), Autocal from front panel or IEEE-488 interface of host calibrator (Slave mode).
Environmental:
Operating temperature: 0°C to +50°C.
Storage temperature: -40°C to +70°C.
Dimensions: 89 mm (3.5 in.) high; 455 mm (17.9 in.) wide; 420 mm (16.5 in.) deep.
Weight: 10 kg (22 lb).
Power: 100/120/220/240 VAC ± 10%, 50 or 60 Hz. Consumption 200W.

OPTIONS & ACCESSORIES

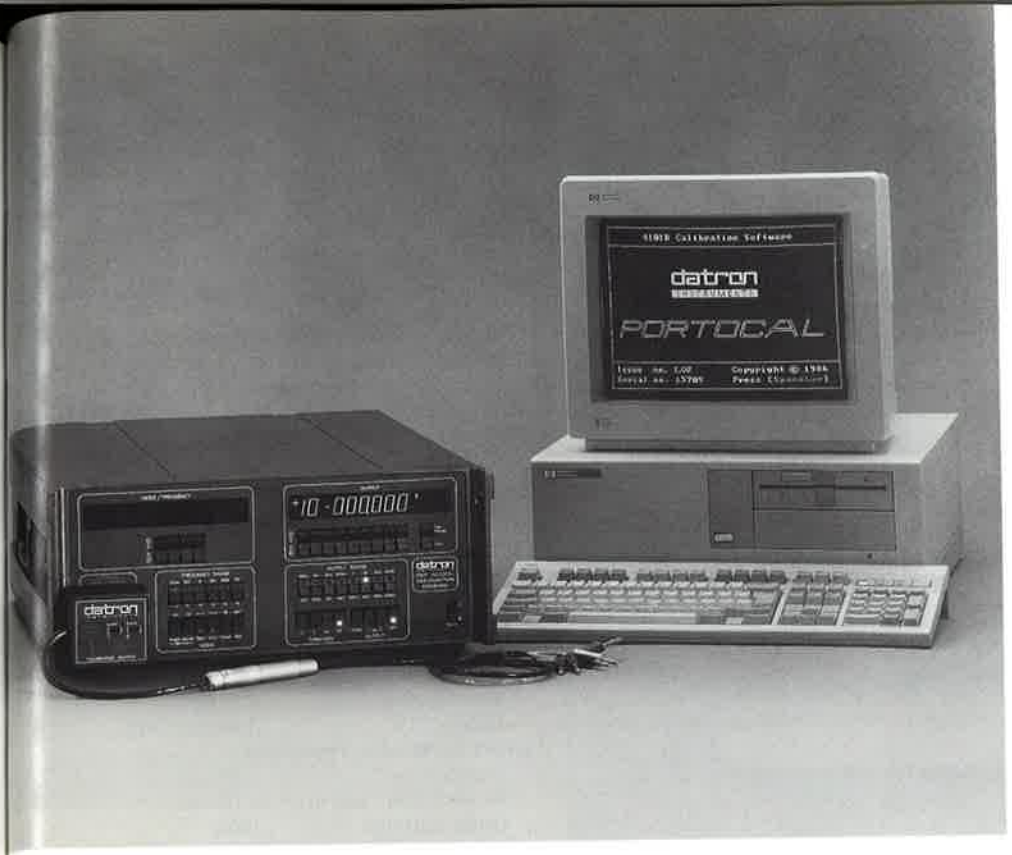
80: 115V 60 Hz Line Operation.
81: 115V 50 Hz Line Operation.
90: Rack Mounting Kit.
440151: Slave Mode Lead Kit.
440154: Current Output Lead Kit.

FACTORY/FOB

Indianapolis, IN & Norwich, England

ORDER INFORMATION

Model 4600
Options 80, 81
Option 90
Accessory 440151
Accessory 440154



Multimeter Calibration Systems

- **Calibrates Any Type of DMM or Analog Meter**
- **Comprehensive Menu Driven Structure**
- **Runs on IBM PC-XT, HP Vectra, Compaq Portable**
- **Extensive Inventory Management Capabilities**
- **Compatible With All Datron Calibrators**

The 4100 PORTOCAL series of multimeter calibration systems offers a selection of high quality systems configured with Datron calibrators, calibration software and accessories. All 4100 systems are supplied with 4101B Portocal Multimeter Calibration Software, a powerful and flexible package which is totally menu driven, and compatible with all Datron calibrators, IBM PC-XT, HP Vectra, and Compaq Portable II controllers.

4101B Software

The Portocal software is a self-contained package resident in its own subdirectory on the hard disk, allowing the controller to be used for tasks other than calibration. It is designed to maximize the effectiveness of the Datron Autocal range of calibrator hardware, and to guide the user in developing and controlling the calibration process, while providing, through the use of passwords, protection against unauthorized modification of any of the calibration procedures or historical data stored on the system.

Its use is not confined to IEEE-488 controllable DMMs. In fact all types of DMMs may be calibrated, from instruments that incorporate some method of electronic calibration such as Autocal, to instruments that are controllable over the IEEE-488 interface but are manually calibrated, to completely manually controlled and calibrated instruments.

Easy to Use

Ease of use is a prime feature of Portocal which, being menu driven, does not require the user to be familiar with instrument controllers or their languages.

Model 4101B Software

Program Size: 1.8 MBytes approx.
Max Number of Calibration Procedures: 999.
Typical Procedure File Size: 10 kBytes.
Max Number of Certificate Designs: 20.
Typical Certificate File Size: 8 kBytes.
Capacity of Instrument Inventory: 32,000.
Typical Instrument File Size: 120 Bytes.
Disk Operating System: PC-DOS 3.0 or later, MS-DOS 3.1 or later.

CONTROLLER CONFIGURATIONS

These are the controller configurations that will support the 4101B software package:
IBM PC-XT
Parallel Printer Adaptor
CGA Color Card
Color Monitor
Keyboard
IBM PC-DOS (3.0 or later)
IBM Basic
Ziatech ZT1488A & zSBX20 Interface Cards (Datron Part 440127-1)

Model 4103A:
HP Vectra ES Model 26 (D1226A)
14 In. Enhanced Monitor (D1182B)
MSDOS 3.3 PAM (45951 DU)
GW Basic (HP45952A)
Ziatech ZT1488A and zSBX20 Interface Cards (Datron Part 440127-1)

Model 4103B
Compaq Portable II Model 3
MS-DOS (3.1 or later).
Basic Interpreter
Ziatech ZT1488A and zSBX20 Interface Cards (Datron Part 440127-1)

Model 4104
Epson Printers: FX80 and FX800 series.

Model 4112 CALIBRATION CART
Includes all power distribution and cabling.

OPTIONS & ACCESSORIES

440127-1: Ziatech ZT1488A and zSBX20 Interfaces
PLK-2: Analog Benchtop Lead Kit. For 4700 Series Configurations.
440154: 11A Current Lead Kit. For use in systems containing model 4600.
400277-0.5: 0.5m IEEE Cable
400277-1: 1m IEEE Cable
400277-2: 2m IEEE Cable

FACTORY/FOB
Indianapolis, IN & Norwich, England

ORDER INFORMATION
Model 4101B
Model 4103A
Model 4103B
Model 4104
Model 4112
Accessory 440127-1
Accessory PLK-2
Accessory 400277-0.5
Accessory 400277-1
Accessory 400277-2
Accessory 440154

DCV References

- **The First Real Alternatives to the Weston Cell**
- **Four Truly Independent 10 Volt Output "Cells"**
- **Hardware Averaging yields 1ppm/year Stability**
- **Overall <0.05ppm/°C for 0° to 40°C Operation**
- **4910 offers Divided Outputs, Buffered Output**
- **7 Day, Protected Battery Backup Transit Mode**

The models 4910 and 4911 are the ultimate in Electronic DC Voltage Reference Standards, establishing a performance benchmark for the assessment of other devices. Offering the traditional benefits of electronic references - ruggedness and ease of use - they are the first solid state devices available featuring sufficient stability to replace the Weston Cell as a company prime DC Voltage Reference Standard.

Versatile Architecture
Both the 4910 and 4911 offer four truly independent 10V output "cells", each possessing its own power supplies and control circuits, allowing direct intercomparison between the output terminals in order to detect and evaluate drift in any cell. Each cell's total independence means that errors arising from circuit elements are uncorrelated and therefore detectable. The output of each cell is adjustable with <0.1 ppm resolution, so that they may be calibrated to nominal to allow intercomparisons with a very high level of accuracy.

The four 10V cells may be selectively averaged in hardware giving a significant benefit in long term stability and short term noise when compared with the output of just one cell. The 10V average output provides the ideal low noise reference against which individual cells may be compared, and in the 4910, is permanently connected to the input of a four wire sensed buffer capable of sourcing 15 mA for driving an accurate voltage into a load without compensations. Cells included within the average group are identified by a front panel LED indicator.

Each cell's independence also allows higher voltages to be obtained by "stacking" cells, to provide up to 40V from one unit.

Model 4910 also offers adjustable outputs at the 1V and 1.018V levels.

Transit Mode
4910/11 feature fully monitored and protected battery backup systems, which can maintain integrity for 7 days. Charging circuitry is integral. Auxiliary inputs allows the use of 10 - 40VDC power.

SPECIFICATIONS

Stability, ppm (±1°C)

	30 days	90 days	1 year
10V Average	0.3	0.8	1.0
10V Cell	0.3	1.0	1.5
4-wire buffer*	0.3	1.0	1.5
1.018V*, 1V*	0.6	1.5	2.0

Temperature Coefficient (0°C - 50°C)

10V Average & Cell	0.05 ppm/°C
4-wire buffer*	0.06 ppm/°C
1.018V*	0.10 ppm/°C
1V*	0.12 ppm/°C

Noise, 0.01Hz - 2Hz

10V Average	0.02 ppm RMS
10V Cell	0.04 ppm RMS
4-wire buffer*	0.03 ppm RMS
1.018V*, 1V*	0.10 ppm RMS

Output Resistance/Protection

4-wire buffer*	<100 μΩ

4-wire buffer* will drive to 15 mA

Other outputs	100Ω

Outputs withstand indefinite shorts, transients to 1100V (to 25 mA).

Setting Resolution

10V Cell	<±0.1 ppm
1.018V*, 1V*	<±0.2 ppm

GENERAL

Environmental
Operating temperature: 0°C to +40°C
Storage temperature: -40°C to +50°C

Dimensions
177 mm (7") high 214 mm (8.5") wide, 591 mm (23.3") depth

Weight: 20Kg (44 lbs)

Power
Line: 100V, 120V, 220V, 240V ±10%, 47-63 Hz, consumption <40VA.
Low voltage input: 10V - 40 Vdc.
Battery Backup, Transit Mode, 7 days at 25°C, to 4 days at 0°C, ambient.

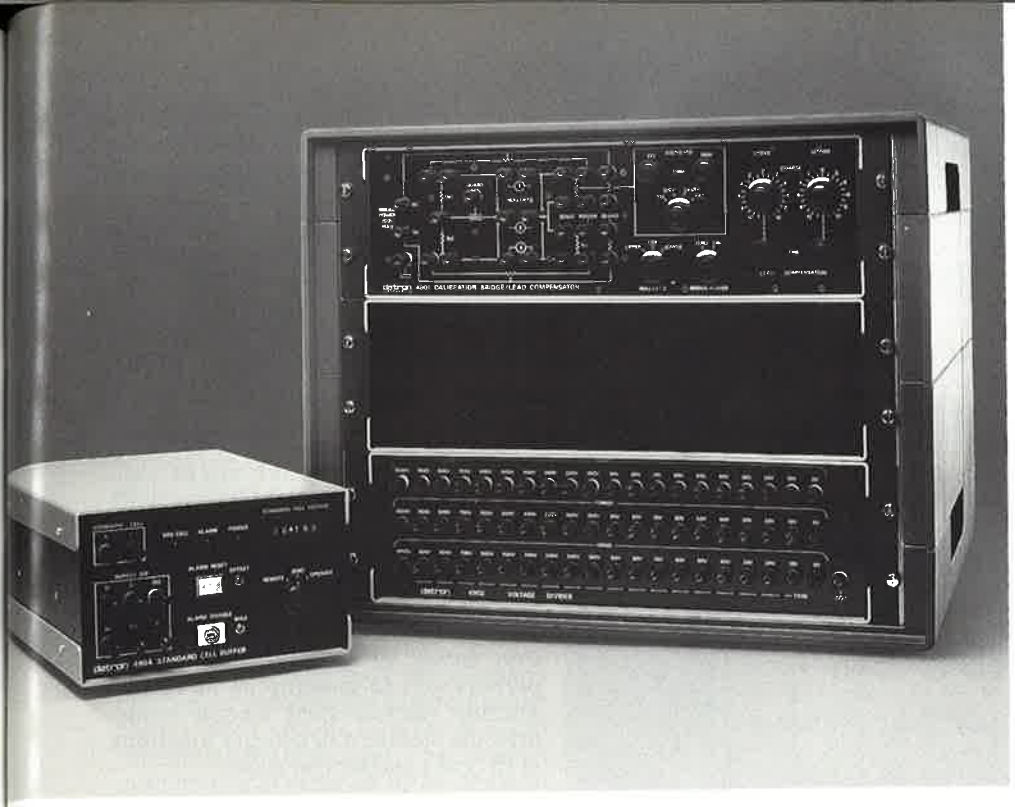
*(*Not applicable to 4911)*

OPTIONS

10: Calibration and hot shipment
20: Drift rate characterization (must be ordered with Option 10)
30: 1.018V set to requested level (must be ordered with Opt. 10)
40: Ruggedized Transit Case
50: Soft Carrying Case
90: Rack Mount Kit

FACTORY / FOB
Indianapolis, IN &
Norwich, England

ORDER INFORMATION
Model 4910
Model 4911
Option 10
Option 20
Option 30
Option 40
Option 50
Option 90



DC Standards

- **4901 Bridge and Lead Compensator**
- **4902S Reference Divider**
- **4904 Standard Cell Buffer**

4902S Reference Divider and 4901 Calibration Bridge
The design and construction of the 4902S Divider and its companion Calibration Bridge (4901) significantly reduces or eliminates the sources of error in traditional divider designs, and is fully capable of providing 10:1 and 100:1 ratio accuracies, with a 100V or 1000V input, to within 0.2 ppm.

The 4902S is a true 4 wire, 5 terminal resistive divider. Each tapping is fully guarded by a companion guard chain, eliminating leakage errors. The guard shield for each tapping is accessible to the user on the front panel, so that effective guard connections can be made to the source of the measured signal. Each resistor element has a maximum of 10V applied to it, so that voltage coefficients and self / mutual heating effects are negligible, ensuring rapid settling times.

The 4901 Calibration Bridge and Lead Compensator is used to calibrate each section of divider to the very highest precision, using ratio techniques approved by National Standards authorities. Calibration of the individual elements of the 4902S at the voltage used during normal operation takes self heating, power and voltage coefficients into account, enabling the unit's 0.2 ppm ratio accuracy.

SPECIFICATIONS (4902S)
Ratio Accuracy: 24 hours, ±1°C, assuming calibration with model 4901 Calibration Bridge: 0.2 ppm (1000:10 and 100:10).
Temperature Coefficient: <0.5 ppm/C.

GENERAL
Environmental: As 4904.
Dimensions: 132 mm (5.25 in.) high; 433 mm (17 in.) wide; 327 mm (12.9 in.) deep.
Weight: 5 kg (11 lb).

SPECIFICATIONS (4901)
Environmental: As 4904.
Dimensions & Weight: As 4902S.

4904 Standard Cell Buffer
This device allows the user to take the accuracy of his sensitive Weston Standard Cells out of the standards laboratory, even onto the production floor, while providing protection against accidental damage by inexperienced operators. It is a low noise, low drift, unity gain amplifier with a 4-wire remote sense output stage so that it may drive Kelvin-Varley type dividers. During operation, it performs a comprehensive sequence of self tests to ensure that all of the internal circuitry is functioning correctly. On detection of an error condition, it immediately disconnects the Standard Cell, and audible and visual alarms signal the user.

SPECIFICATIONS (4904)
Input Voltage Range: 1 to 10 Standard Cell outputs: 1.0V to 10.2V.
Offset Voltage: <0.1 µV.
Noise: 0.3 µV pk-pk.
Input Current: <5 pA.
Output Current: 15 mA.
Output Resistance: <0.1 mΩ.

GENERAL
Environmental:
Operating temp: 0°C to +30°C.
Storage temp: -40°C to +70°C.
Relative Humidity: <75% (0°- +30°C).
Dimensions: 132 mm (5.25 in.) high; 222 mm (8.75 in.) wide; 327 mm (12.9 in.) deep.
Weight: 5 kg (11 lb).
Power: 100/120/220/240 Vac ±10%, 50 Hz or 60 Hz. Consumption 8VA.

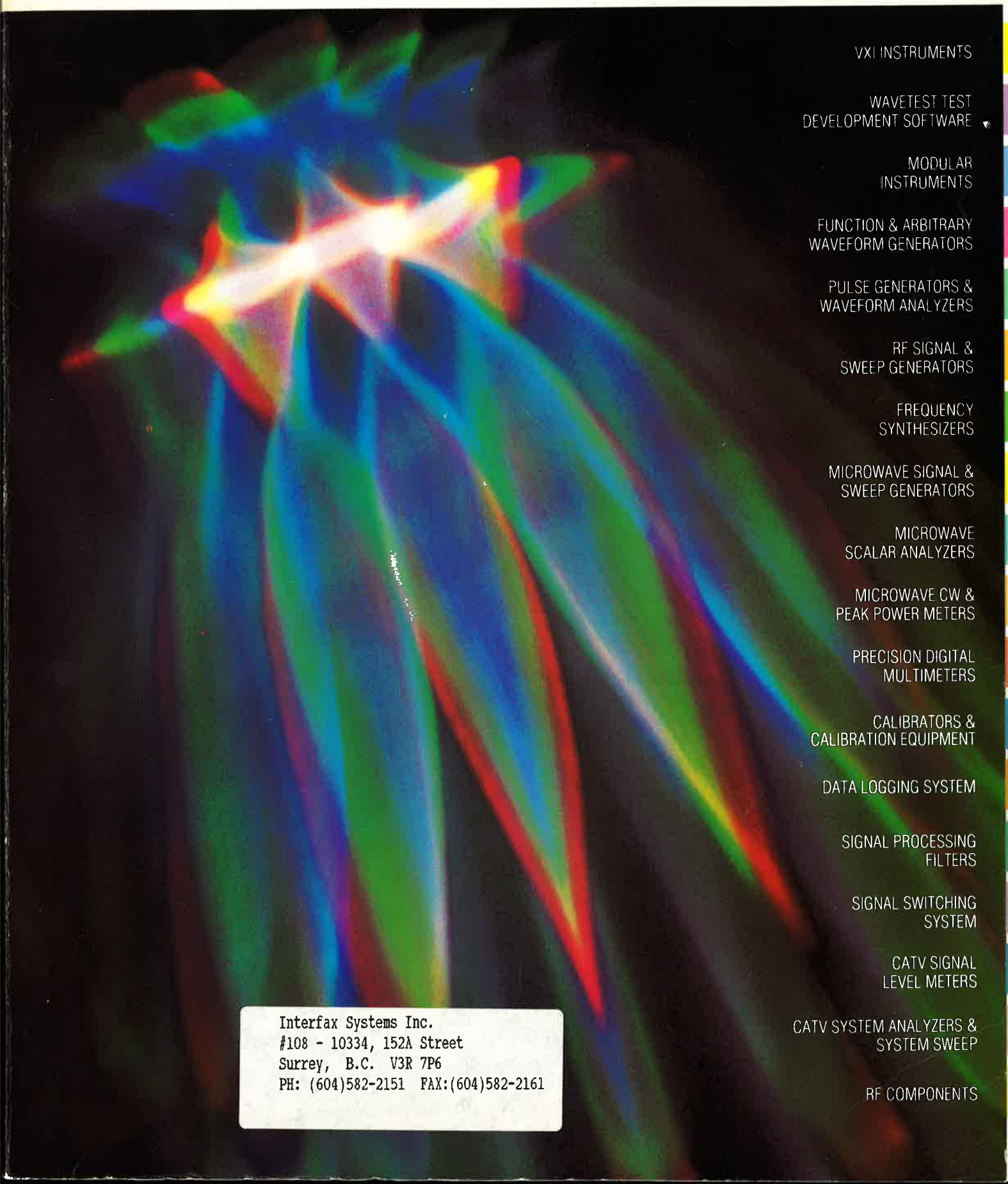
OPTIONS
10:
20: System Cabinet (6U)
30: System Lead Kit for 4902S
90: Rack Mounting Kit. Specify model being mounted.

FACTORY/FOB
Indianapolis, IN & Norwich, England

ORDER INFORMATION
Model 4901
Model 4902S
Model 4904
Option 20
Option 30
Option 90

WAVETEK®

TEST & MEASUREMENT
INSTRUMENTATION 1990



VXI INSTRUMENTS

WAVETEST TEST
DEVELOPMENT SOFTWARE

MODULAR
INSTRUMENTS

FUNCTION & ARBITRARY
WAVEFORM GENERATORS

PULSE GENERATORS &
WAVEFORM ANALYZERS

RF SIGNAL &
SWEEP GENERATORS

FREQUENCY
SYNTHESIZERS

MICROWAVE SIGNAL &
SWEEP GENERATORS

MICROWAVE
SCALAR ANALYZERS

MICROWAVE CW &
PEAK POWER METERS

PRECISION DIGITAL
MULTIMETERS

CALIBRATORS &
CALIBRATION EQUIPMENT

DATA LOGGING SYSTEM

SIGNAL PROCESSING
FILTERS

SIGNAL SWITCHING
SYSTEM

CATV SIGNAL
LEVEL METERS

CATV SYSTEM ANALYZERS &
SYSTEM SWEEP

RF COMPONENTS