

4800 Series

The precision to meet demanding calibration workloads

Meeting the demands of an increasingly varied electrical calibration workload means you must find a calibrator that can reach the performance limits of the latest 7-1/2 and 8-1/2 digit high-precision DMMs, while still handling volume throughput of 3-1/2 digit to 6-1/2 digit instruments with efficiency and ease. In the search for accuracy, versatility, safety and ease-of-use you need look no further, because Wavetek 4800-Series calibrators have no equal.

Extended Functionality

In a single unit, the Model 4800A offers Voltage, Current and Resistance calibration for instruments with scale lengths up to 7-1/2 digits. Yet its fixed

build configuration allows us to offer it at a price significantly less than that of comparable multi-function calibrators on the market.

The Model 4808 not only extends workload coverage to 8-1/2 digits, it also offers you a choice of configurations — from DC or AC Voltage only units to full-function DC/AC Voltage, DC/AC Current and Resistance versions. Modular plug-ins provide a continuous upgrade path from one configuration to the next. As far as accuracy is concerned, the Model 4808 is quite simply the best multi-function calibrator you can buy.

Unlike some other multifunction calibrators, 4800-Series calibrators

reach the performance limits of your workload without the need for an external power amplifier. Their built-in volt.hertz capability allows them to reach 1100V at 33 kHz or 750V at 100 kHz — essential for calibrating high-end DMMs such as the Solartron 7061 and Wavetek 1271. Their 25 mA DC voltage drive capability maintains accuracy even when calibrating low input impedance voltmeters.

If you do need to extend their output range, we have a wideband option that extends frequency coverage from 1 MHz to 30 MHz, and a transconductance amplifier that delivers DC/AC currents up to 11A.



More Application, Information, and Pricing available at:



250 Technology Way
Rocklin, CA 95765

sales@testworld.com
1-855-200-TEST (8378)

Click to go www.TestWorld.com

Automated Calibration

In addition to the hardware, we also have the support software you'll need to automate your calibration operations and manage your calibration workload. Wavetek's Portocal-II Calibration and Inventory Management Software, for example, allows you to automate calibration operations, analyze calibration results, produce comprehensive calibration certificates and reports, and track an unlimited inventory of instruments.

And when the time comes to recalibrate your 4800-Series calibrator, our software controlled Model 4950 Multifunction Transfer Standard (MTS) can automate this task as well.

Consistent Performance

The exceptional stability of 4800-Series calibrators, achieved through the use of specially conditioned zener references, ultra-linear pulse-width modulation D/A converters

and the latest resistor technologies, means they easily meet their uncertainty specifications over 180-day or 1-year calibration intervals. One-year stability figures for the Model 4808, for example, are an exceptional 6 ppm for DC voltage, 50 ppm for AC voltage, 40 ppm for DC current, 100 ppm for AC current and 9 ppm for Ohms. Zero to full-range linearity is better than 0.1 ppm of full-scale — guaranteed for life.

And if you don't like the thought of losing the use of your calibrator once or twice a year while it's at the cal lab, you can take advantage of Wavetek's unique, fully accredited, on-site calibration service.



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Designed for Accuracy and Versatility

Both the Model 4800A and 4808 calibrators deliver DC voltage from zero to -1100V, AC voltage from 90mV to 1100V with frequency availability between 10 Hz and 1 MHz, DC and AC current up to 2A, and decade resistance values between zero and 100 MW — all from a single set of terminals which feature local or remote guarding and 2-wire or 4-wire connections. And they both accept the wideband and trans-conductance amplifier options which extend their output capabilities to 30 MHz and 11A (dc to 20kHz) respectively.

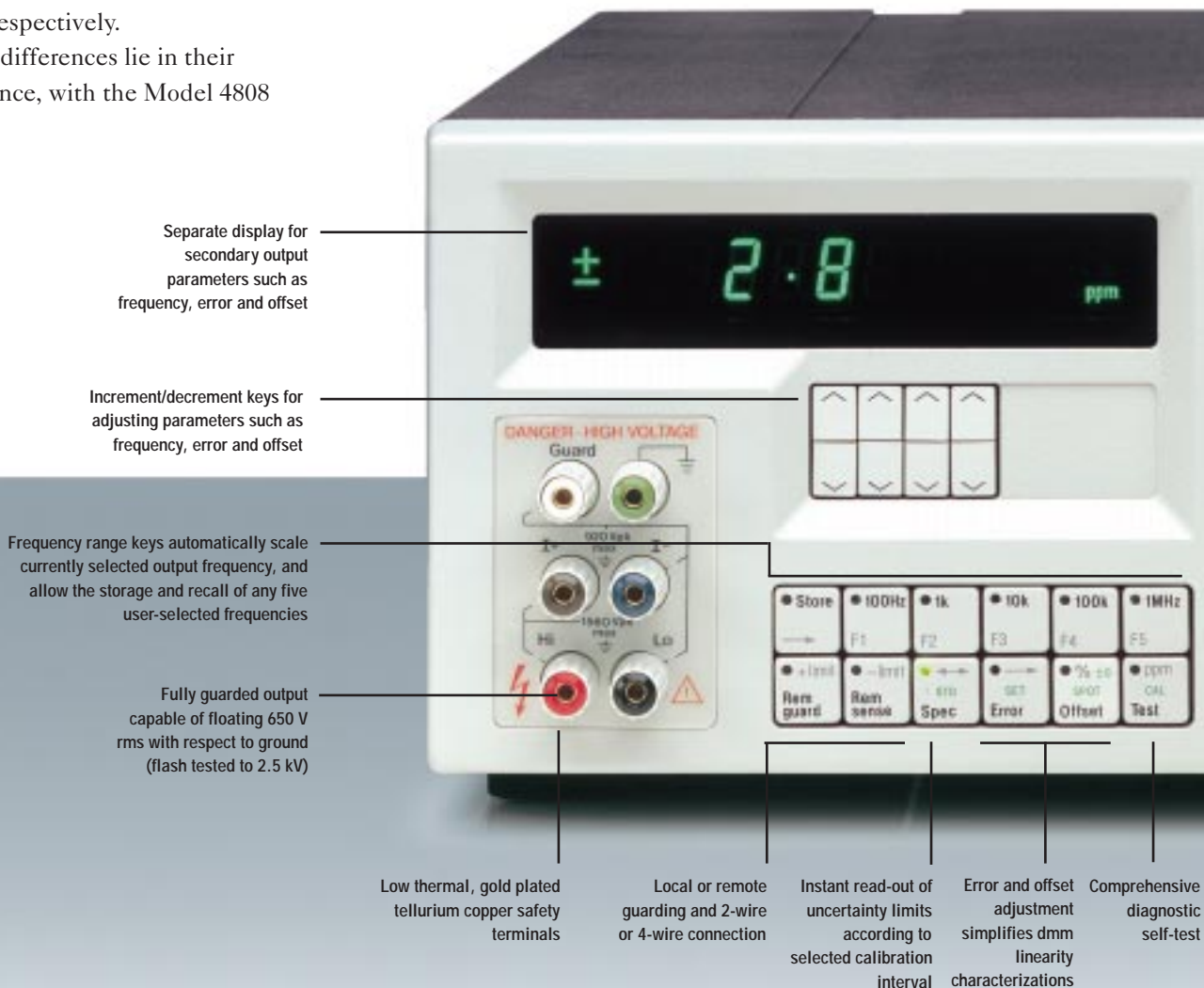
Their differences lie in their performance, with the Model 4808

being designed to deliver 1-year uncertainties relative to calibration standards around two times better than the Model 4800A. Coupled with the Model 4808's unique ability to 'spot calibrate' as many as five separate user-defined frequencies for each of its seven AC voltage ranges, this makes it the 'calibrator of choice' for calibrating the world's best 8-1/2 digit high-precision DMMs.

All 4800-Series calibrators feature the same easy-to-use front panel controls — with single key-stroke range and function selection, simple control of output values, and large high-brightness displays for an unambiguous indication of output

conditions. Their ability to store and recall any five user-defined frequencies makes ac flatness testing extremely easy. Their offset and error modes provide a direct readout of unit-under-test errors and allow you to compensate an instrument's zero and gain errors in order to perform precise linearity checks.

And if you want to incorporate 4800-Series calibrators into automated systems, everything you can do from the front-panel (plus several features you can't access from the front-panel) can be controlled over the IEEE-488 (GPIB) bus.



Separate display for secondary output parameters such as frequency, error and offset

Increment/decrement keys for adjusting parameters such as frequency, error and offset

Frequency range keys automatically scale currently selected output frequency, and allow the storage and recall of any five user-selected frequencies

Fully guarded output capable of floating 650 V rms with respect to ground (flash tested to 2.5 kV)

Low thermal, gold plated tellurium copper safety terminals

Local or remote guarding and 2-wire or 4-wire connection

Instant read-out of uncertainty limits according to selected calibration interval

Error and offset adjustment simplifies dmm linearity characterizations

Comprehensive diagnostic self-test

Built for Safety and Reliability

So that you can meet stringent health and safety requirements, operator protection is a built-in feature of the Model 4800A and 4808 calibrators. Selection of voltages which peak above 110V, for example, results in visible and audible warnings before these voltages appear at the output terminals. All front-panel terminals are fully shrouded to minimize the possibility of accidental contact, and if an operator does come into contact with voltages on the Hi or Lo output terminals, the ability of

these terminals to float at least 650 V rms with respect to ground minimizes the risk of ground return paths creating a lethal shock hazard. To make sure, we flash-test every 4800-Series calibrator we manufacture at 2.5 kV (to full IEC Standards) in order to check the isolation between its guard and earth terminals. Both the Model 4800A and 4808 carry the internationally recognised CE marking.

In addition to protecting their operator, 4800-Series calibrators also look after themselves. Voltage outputs are protected against reverse emfs up to 1000V by automatically tripping the output

into the off-state as soon as an over-voltage condition is detected, and current and resistance outputs are protected by high-speed fuses. Both calibrators also contain special circuitry which continuously monitors internal temperatures and loading conditions, turning the output off before damage can occur.

For even greater operator confidence, Wavetek's 4800-Series calibrators also feature diagnostic self-test routines which locate faults down to easily replaced circuit modules — greatly simplifying service and repair.

All 4800-Series calibrators are fully supported for repair and recalibration (on-site or off-site) by our worldwide network of Service Centers.



Single keystroke full-range selection

Increment/decrement keys provide individual control over each output digit, with full roll-over capability

Single-keystroke zero selection

Amplitude range keys automatically scale currently selected output amplitude and allow simple decade range selection

Easily accessed power switch with line voltage selection on rear-panel

Single-keystroke function selection

Resets calibrator after external overload

Simple output on/off and polarity control with visible and audible warnings if peak output values exceed 110V

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Wideband Source (Option 70)

The Wideband Source option (Option 70) enhances the performance limits of any 4800-Series calibrator by extending its frequency range to 30 MHz. Its 50W output delivers precision voltages between 300 mV and 3.5V, selectable either as absolute values with 6-1/2 digit resolution or as dBm values over the range -57 dBm to +24 dBm (referenced to 50W).

Integrated below the base unit of the calibrator and fully controlled via the calibrator's normal front-

panel controls or IEEE-488 bus interface, this option allows your calibration workload to include equipment such as RF voltmeters, extended frequency range DMMs, and precision RF filters.

Utilizing the latest DDS (Direct Digital Synthesis) techniques, the Wideband Option achieves exceptional amplitude flatness over its entire frequency range, crystal controlled 0.01% frequency uncertainty and excellent frequency resolution — 10 kHz between 340 kHz and 3 MHz and 100 kHz from 3 MHz to 30 MHz. Harmonic distortion is typically better than



-50 dB, with spurious frequency outputs typically better than -56 dB and settling times at less than half a second. The Wideband Source option is fully compatible with all other 4800-Series calibrator options.





Model 4600 Transconductance Amplifier (Option 60)

Extending the DC and AC rms current output capabilities of 4800-Series calibrators to $-11A$, the Model 4600 Transconductance Amplifier (Option 60) gives you the ability to fully test and calibrate the 3A and 10A current ranges which frequently appear on hand-held and bench-top DMMs, data loggers and recorders. Its AC frequency range extends from 10 Hz to 20 kHz.

Controlled from the calibrator's normal front-panel keyboard or IEEE-488 interface and driven by an AC or DC voltage from the calibrator, the Model 4600 Transconductance Amplifier becomes an integral part of the

calibration system. It is even accounted for in the calibrator's 'Autocal' digital calibration memories, eliminating the need for manual adjustments, and adding as little as 175 ppm uncertainty to the calibrator's 1-year DC Voltage specifications and 360 ppm to its 1-year AC Voltage specifications. A voltage compliance in excess of 2V for DC and AC output currents allows the Model 4600 to drive relatively high-value current shunts without affecting uncertainty specifications.

The Model 4600's output is fully protected against open-circuit and short-circuit conditions, and it has

front-panel LEDs to indicate operating status and fault conditions. Although the 4800-Series calibrator to which it is connected must have the appropriate DC or AC voltage and current options fitted, the Model 4600 is otherwise compatible with all other calibrator options. By driving its front-panel input terminals from an independent voltage source, it can also be used as a stand-alone 1 amp/volt transconductance amplifier.

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Portocal-II — Windows™ Compatible Software for Controlling Workload, Results and Documentation

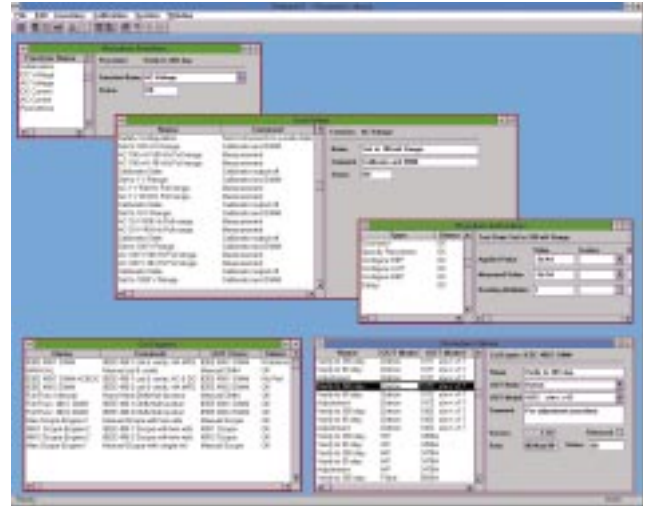
Connect up any 4800-Series calibrator to a PC running Wavetek's Portocal-II Calibration Management Software and you have a powerful system which will automate calibration operations, document calibration results, manage an entire instrument inventory, and allow you to develop calibration procedures for new instruments. Running under Windows™ and supporting multi-user networked access to its database files, Portocal-II implements advanced features such as the maintenance of ISO9000 compliant traceability, custom certificate and report generation, and high-level procedure programming.

Simplifying Calibration Operations

Using text and graphic images to show the operator how to make the necessary lead connections, Portocal-II controls a 4800-Series calibrator and the unit-under-test

via the IEEE-488 bus to fully automate the calibration process. Even if the instrument being calibrated cannot be controlled via the bus, Portocal-II still guides the operator step-by-step through the calibration procedure, visually indicating any manual intervention which is required. The result is higher workload throughput, greater process consistency, minimization of human error, and less requirement for operator training — in short, higher quality at lower cost.

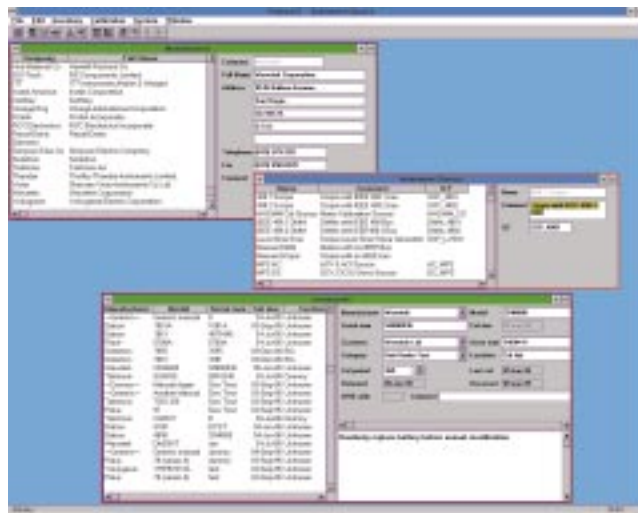
Portocal-II is supplied with an extensive library of fully tested calibration procedures for instruments that can be calibrated by 4800-Series calibrators, or by other calibrators which the software supports. These include the Wavetek Model 9100 Multi-Product Calibrator and Model 9500 Oscilloscope Calibrator, both of which are capable of fully automating the



calibration process. Other calibrators supported include commonly used models from Fluke and Tektronix.

Syntax-free Procedure Generation

Sooner or later, you'll probably need calibration procedures for new or unusual instruments. If these are not already available as part of Wavetek's procedure update program (call your local sales office for the latest information), you can write them yourself using Portocal-II's integrated procedure generator. Featuring a high-level menu-based programming technique which eliminates any need to remember complicated syntax rules, programming instructions or IEEE-488 commands, Portocal-II makes procedure generation simplicity itself. You can even cut and paste sections of one procedure into another one so that you can easily re-use routines that you know to work.



Keeping Track of Instruments and Results

Generating and executing calibration procedures is only one part of Portocal-II's overall capability. At the heart of the Portocal-II software is a powerful inventory management system which allows you to maintain comprehensive records on every item of equipment that you have to calibrate, and on every calibrator which you use to calibrate them. For example, Portocal-II's inventory records contain all the information required to uniquely define a particular instrument, together with details of its current owner and calibration due date. You can use this information to assess your future calibration workload on a month-by-month or week-by-week basis, and mailmerge the information to generate recall notices for the appropriate instruments.

Whenever you calibrate an instrument on a Portocal-II system, all the calibration results produced are date stamped and locked to the appropriate instrument's inventory record. As you continue to use the system, Portocal-II automatically builds a complete calibration history for each instrument, providing important data for statistical process control programs and allowing the optimum calibration interval for the instrument to be evaluated.

Producing Documentation

Because the data in any database is only as good as your means of accessing it, we've integrated the industry's most powerful database reporting program into the Portocal-II Software — R&R Report Writer from Concentric Data Systems Inc. R&R Report Writer gives you the

ability to generate custom calibration certificates that incorporate your own headers, footers and logo graphics, and to produce management reports that present your data in the most meaningful and understandable form. It also gives you the ability to export data from Portocal-II in a variety of different industry-standard formats so that it can be used in statistical control programs.

Networking for Efficiency

Portocal-II not only operates under the Windows® operating system, it also has powerful networking capabilities. As a result, inventory management, procedure generation and report writing activities can be carried out on peripheral computers, without disturbing productive use of your Portocal-II system as a calibration workstation.



* Windows 95 or Windows for Workgroups 3.11 or higher.

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The Model 4950 MTS — On-Site Calibrator Support

As an alternative to sending your 4800-Series calibrator to an accredited laboratory for routine recalibration, you can also take advantage of Wavetek's unique on-site calibration service. Utilizing our Model 4950 MTS, and carrying full Category-1 NAMAS or DKD accreditation*, this service allows you to carry out complete calibration and adjustment of a 4800-Series calibrator (and other calibrators in the Wavetek range) at a time and place of your own choosing, without incurring expensive labour charges or downtime penalties.

Unlike some other manufacturers' calibrator support strategies which attempt to maintain AC traceability using DC artefacts, the Model 4950 MTS calibrates every single one of

the calibrator's ranges and functions against higher order metrology standards. As a result, you'll have the highest possible confidence in your calibrator's ability to pass on an unbroken chain of traceability to the instruments you calibrate with it.

Closing the Loop for Enhanced Confidence Levels

Using our on-site calibration service is extremely easy. You simply supply us with details of your calibrator and the environment in which it is operated. Then we send you a Model 4950 MTS which has been fully characterized against high-accuracy standards immediately before shipment.

The Model 4950 MTS travels in a special transit case which protects it from mechanical shock or sudden changes of temperature so that it arrives in perfect condition. (The system is even equipped with shock,

vibration and temperature monitors so that you can check that the MTS hasn't received adverse handling.) We even include a portable PC into which we've installed a fully automated calibration program — saving you the time and expense of dedicating a skilled calibration engineer to the task.

Simply connect your calibrator to the Model 4950 MTS and the PC using the cables supplied and start the calibration program. The program prompts you to perform any manual operations that are required, such as setting the correct IEEE-488 addresses on the instruments and turning the calibration key on the calibrator's back panel, and then performs the entire calibration/adjustment process automatically. When it's finished, you re-pack the Model 4950 and computer back into its transit case and return it to us. It's as simple as that.





When we receive the Model 4950 MTS, we close the calibration loop by checking it against the same standards that were used to calibrate it before shipment — thereby verifying that its performance has remained unaltered. Then we issue the calibration certificate for your calibrator.

Dual Calibration Memories Maintain Best Metrology Practice

The unique 'shadow cal' facility provided on 4800-Series calibrators means that the adjustments made to your calibrator during the on-site part of this calibration process won't have to be implemented until after you receive the certificate — thereby maintaining best practice metrology principles throughout.

By transferring the existing calibration constants from the calibrator's 'Autocal' memory into its 'Shadow Cal' memory before you allow the Model 4950 system to

make adjustments, the calibrator's original calibration state can be maintained until you receive the new calibration certificate. Two front-panel keystrokes are then all it takes to switch the calibrator back to its normal 'Autocal' memory, where the new calibration constants are stored.

Of course, you don't have to use our on-site calibration service to take advantage of the Model 4950 MTS. For example, you could opt to purchase a unit so that you can operate an in-house calibration

service, using one of your own calibrators to provide the necessary closed-loop verification of the Model 4950's performance before and after it travels to a suitably accredited calibration laboratory for routine recalibration. And remember that the Model 4950 not only supports Wavetek 4800-Series calibrators. It can also calibrate and adjust Wavetek 9000-Series Multi-Product calibrators and fully calibrate (on every range and function) Fluke's Model 5700A and 5100B calibrators.

Model 4950 Closed-Loop Calibration Uncertainties*

Uncertainties are expressed in ppm and assume successful loop closure.

Function	Range	Lowest Uncertainty in Range
DC Voltage	-100mV to -1000V	2.1
AC Voltage	1mV to 1000V 10Hz to 1MHz	26
DC Current	-100µA to -10A	13
AC Current	100µA to 10A 10Hz to 30kHz	85
Resistance	1Ω to 100MΩ	4.5

*NAMAS Accreditation No. 0183SI Calibration (granted by UKAS to Wavetek Ltd, Norwich, UK.)
DKD Accreditation No. DKD-K-08201 (granted to Wavetek GmbH, Munich, Germany)

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4800A Uncertainty Specifications Relative to Calibration Standards.

4800A DC Voltage Relative Uncertainty – (ppm OUTPUT + mV Floor)^[1]

Range	24Hr Stability ^[2]	90 Days Tcert ^[3] – 1 C	180 Days Tcert ^[3] – 5 C	365 Days Tcert ^[3] – 5 C	Temperature
100mV	1.2 + 0.4	4.5 + 0.5	5.5 + 0.5	7.5 + 0.5	1
1V	1 + 1	4 + 1	6 + 1	7 + 1	0.5
10V	0.6 + 2	2.5 + 4	5 + 4	6.5 + 4	0.15
100V	1 + 30	4 + 50	6 + 50	8 + 50	0.5
1000V	1 + 300	5 + 500	7.5 + 500	9.5 + 500	0.5

Scale Length: 0 to –200% of range (100mV to 100V ranges); 0 to –110% of range (1000V range).

Settling Time: <1s to 10ppm of step size.

Settling Resolution: 0.1ppm or 10nV

Maximum Load : 25mA on 1V to 1000V ranges.

Output Impedance 100W on 100mV to 100mV ranges.

4800A AC Voltage Relative Uncertainty – (ppm OUTPUT + mV Floor)^[1]

Range	Frequency Band	24Hr Stability ^[2]	90 Days Tcert ^[3] – 1 C	180 Days Tcert ^[3] – 5 C	365 Days Tcert ^[3] – 5 C	Temperature Coefficient ^[4]
100mV ^[5]	10 - 31	80 + 8	100 + 9	120 + 9	140 + 9	10
	32 - 330	60 + 8	100 + 9	105 + 9	110 + 9	5
	300 - 10k	45 + 8	45 + 9	60 + 9	70 + 9	5
	10k - 33k	50 + 8	65 + 9	95 + 9	130 + 9	5
	30k - 100k	60 + 8	290 + 9	300 + 9	310 + 9	10
	100k - 330k	160 + 20	800 + 40	900 + 40	0.12% + 40	20
	300k - 1M	260 + 40	0.22% + 140	0.23% + 140	0.25% + 140	50
1V	10 - 31	80 + 20	110 + 30	120 + 30	130 + 30	5
	32 - 330	40 + 10	45 + 20	60 + 20	80 + 20	5
	300 - 33k	40 + 5	45 + 10	60 + 10	80 + 10	3
	30k - 100k	40 + 10	105 + 20	135 + 20	145 + 20	5
	100k - 330k	100 + 20	405 + 100	415 + 100	430 + 100	15
	300k - 1M	240 + 20	0.22% + 400	0.23% + 400	0.24% + 400	100
10V	10 - 31	80 + 200	110 + 300	125 + 300	135 + 300	5
	32 - 330	40 + 100	45 + 200	60 + 200	80 + 200	5
	300 - 33k	40 + 50	45 + 100	60 + 100	80 + 100	3
	30k - 100k	40 + 100	110 + 200	140 + 200	150 + 200	5
	100k - 330k	100 + 200	320 + 1 mV	360 + 1 mV	400 + 1 mV	15
	300k - 1M	240 + 200	0.24% + 5 mV	0.25% + 5 mV	0.26% + 5 mV	100
100V	10 - 31	80 + 2 mV	150 + 3 mV	160 + 3 mV	190 + 3 mV	5
	32 - 330	40 + 1 mV	80 + 2 mV	100 + 2 mV	120 + 2 mV	5
	300 - 10k	40 + 400	50 + 1 mV	75 + 1 mV	80 + 1 mV	3
	10k - 33k	40 + 400	80 + 2 mV	85 + 2 mV	90 + 2 mV	3
	30k - 100k	40 + 1 mV	250 + 3 mV	275 + 3 mV	300 + 3 mV	10
	100k - 330k	60 + 2 mV	580 + 50 mV ^[6]	645 + 50 mV ^[6]	860 + 50 mV ^[6]	30
	330k - 1M	700 + 15 mV	0.85% + 130 mV ^[6]	0.9% + 130 mV ^[6]	0.95% + 130 mV ^[6]	90
1000V	10 - 31	100 + 10 mV	210 + 20 mV	215 + 20 mV	225 + 20 mV	5
	32 - 330	60 + 4 mV	210 + 20 mV	215 + 20 mV	225 + 20 mV	5
	300 - 3.3k	60 + 4 mV	160 + 20 mV	170 + 20 mV	180 + 20 mV	5
	3k - 10k	60 + 4 mV	160 + 20 mV	170 + 20 mV	180 + 20 mV	5
	10k - 33k	100 + 20 mV	200 + 40 mV	205 + 40 mV	210 + 40 mV	5
	30k - 100k	150 + 20 mV ^[6]	870 + 40 mV ^[6]	925 + 40 mV ^[6]	0.14% + 40 mV ^[6]	7

Scale Length: 9% to 200% of range (1mV to 100V ranges); 9% to 110% of range (1000V range).

Settling Time (to 100ppm of step size):

< 10s from 10Hz to 32Hz; < 3s from 33Hz to 330Hz;

< 1s above 330Hz. These figures x2 for range changes.

Max Resistive Load: Output Impedance
30W on 1mV to 100mV ranges; 50mA rms on 1V
range; 60mA rms on 10V range; 120mA rms on
100V range; 15mA rms on 1000V range, < 3kHz;
65mA rms on 1000V range, > 3kHz.

Setting Resolution: 1ppm or 100nV

Max Capacitive Load: 1000pF (1V to 100V
ranges); 300pF (1000V range).

Frequency Uncertainty: <– 100ppm for life.

4800A DC Current Relative Uncertainty – (ppm OUTPUT + mA Floor)^[1]

Range	24Hr Stability ^[2]	90 Days Tcert ^[3] – 1 C	180 Days Tcert ^[3] – 5 C	365 Days Tcert ^[3] – 5 C	Temperature Coefficient ^[4]
100mA	7 + 2 nA	60 + 2 nA	80 + 2 nA	112 + 2 nA	20
1mA	7 + 10nA	37 + 20 nA	45 + 20 nA	58 + 20 nA	10
10mA	7 + 100 nA	37 + 100 nA	45 + 100 nA	65 + 100 nA	10
100mA	7 + 1	35 + 1	45 + 1	55 + 1	10
1A	15 + 20	55 + 30	77 + 30	125 + 30	20
10A ^[7]	15 + 200	70 + 500	115 + 500	160 + 500	20

Scale Length: 0 to –200% of range (100mA to 1A ranges); 0 to –100% of range (10A range).
 Settling Time: < 1s to full specification (100mA to 1A ranges); < 1s to 40ppm of step size (10A range).
 Settling Resolution: 1ppm
 Compliance Voltage: 3V on 100mA to 1A ranges; 2V on 10A range.

4800A AC Current Relative Uncertainty – (ppm OUTPUT + mA Floor)^[1]

Range	Frequency Band	24Hr Stability ^[2]	90 Days Tcert ^[3] – 1 C	180 Days Tcert ^[3] – 5 C	365 Days Tcert ^[3] – 5 C	Temperature Coefficient ^[4]
100mA	10 - 1k	50 + 4 nA	120 + 6 nA	135 + 10 nA	150 + 10 nA	10
	1k - 5k	70 + 6 nA	290 + 8 nA	315 + 14 nA	350 + 14 nA	20
1mA	10 - 1k	30 + 20 nA	70 + 60 nA	85 + 0.1	100 + 0.1	10
	1k - 5k	40 + 20 nA	135 + 60 nA	180 + 0.1	246 + 0.1	10
10mA	10 - 1k	30 + 0.2	70 + 0.6	85 + 1	100 + 1	10
	1k - 5k	40 + 0.2	150 + 0.6	190 + 1	250 + 1	10
100mA	10 - 1k	30 + 2	70 + 6	85 + 10	100 + 10	10
	1k - 5k	40 + 2	150 + 6	190 + 10	252 + 10	10
1A	10 - 1k	50 + 40	250 + 60	275 + 100	300 + 100	20
	1k - 5k	70 + 60	410 + 80	450 + 140	470 + 140	25
10A ^[7]	10 - 1k	40 + 400	300 + 2 mA	350 + 2 mA	400 + 2 mA	13
	1k - 5k	75 + 600	750 + 2 mA	800 + 2 mA	850 + 2 mA	28
	5k - 10k	400 + 1.2 mA	0.15% + 6 mA	0.18% + 6 mA	0.22% + 6 mA	50
	10k - 20k	0.2% + 3 mA	0.55% + 32 mA	0.63% + 32 mA	0.72% + 32 mA	50

Scale Length: 9% to 200% of range (100mA to 1A ranges); 9% to 110% of range (10A range).
 Settling Time: As AC Voltage.
 Frequency Uncertainty: As AC Voltage.
 Max Reactive Load: 10nF, 1mH (time constant <1ms).
 Settling Resolution: 1ppm
 Compliance Voltage: 3V rms on 100mA to 1A ranges; 2V rms on 10A range.

4800A Resistance Relative Uncertainty – (ppm OUTPUT)^[1]

Range	24Hr Stability ^[1]	90 Days Tcert ^[3] – 1 C	180 Days Tcert ^[3] – 5 C	365 Days Tcert ^[3] – 5 C	Temperature Coefficient ^[4]
10 Ohm	6	15	25	35	6
100 Ohm	2.5	4	10	15	2
1k Ohm	2.5	4	10	15	2
10k Ohm	2.5	4	10	15	2
100k Ohm	2.5	4	10	15	2
1M Ohm	6	15	27	38	6
10M Ohm	15	40	59	78	10
100M Ohm	30	50	115	150	20

Display Resolution: 0.1ppm
 Connections: Programmable 2-wire/4-wire sense. Programmable remote/local guard.
 Fuse Protection: to 120V rms

[1] All Relative Uncertainty specifications calculated to a 99% confidence level. Methods of combining uncertainty of calibration standards should comply with the requirements defined in documents ISO TAG4 and NIST Technical Note 1297.

[2] 24Hr Stability are relative to calibration standards for same conditions between 18 C and 28 C

[3] Tcert = temperature at certification. Factory Calibration Temperature = 23 C

[4] Temperature Coefficient (ppm/ C) applies outside –5 Tcert bands.

[5] For 1 mV and 10 mV ac voltage ranges multiply the floor value by 0.6 for frequencies below 300 kHz and 0.2 for frequencies >300 kHz.

[6] For loads >50mA add $\frac{F(\text{kHz}) \times I(\text{mA}) - 5}{75}$ ppm.

[7] Requires option 60 transconductance amplifier.

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4808 Uncertainty Specifications Relative to Calibration Standards.

4808 DC Voltage Relative Uncertainty – (ppm OUTPUT + mV Floor)^[1]

Range	24Hr Stability ^[2]	90 Days Tcert ^[3] – 1 C	180 Days Tcert ^[3] – 5 C	365 Days Tcert ^[3] – 5 C	Temperature Coefficient ^[4]
100mV	0.4 + 0.3	3 + 0.4	4.5 + 0.5	7 + 0.5	1
1V	0.3 + 0.5	2 + 0.8	3.5 + 1	5 + 1	0.5
10V	0.3 + 1	1 + 3	2 + 3	3 + 3	0.15
100V	0.5 + 20	2 + 50	3.5 + 50	5 + 50	0.5
1000V	0.5 + 200	3 + 500	5 + 500	7 + 500	0.5

Scale Length: 0 to –200% of range (100mV to 100V ranges); 0 to –110% of range (1000V range).

Settling Time: <1s to 10ppm of step size.
Settling Resolution: 0.1ppm or 10nV

Maximum Load : 25mA on 1V to 1000V ranges.
Output Impedance 100w on 100mV to 100mV ranges.

4808 AC Voltage Relative Uncertainty – (ppm OUTPUT + mV Floor)^[1]

Range	Frequency Band	24Hr Stability ^[2]	90 Days Tcert ^[3] – 1 C		180 Days Tcert ^[3] – 5 C		365 Days Tcert ^[3] – 5 C		Temperature Coefficient ^[4]
			Spot Freq	Broadband	Spot Freq	Broadband	Spot Freq	Broadband	
100mV ^[5]	10 - 31	60 + 6	90 + 5	90 + 9	95 + 5	110 + 9	100 + 5	120 + 9	5
	32 - 330	30 + 6	40 + 5	40 + 9	45 + 5	60 + 9	50 + 5	70 + 9	5
	300 - 10k	20 + 6	30 + 5	30 + 9	35 + 5	50 + 9	40 + 5	60 + 9	5
	10k - 33k	20 + 6	40 + 5	40 + 9	45 + 5	60 + 9	50 + 5	70 + 9	5
	30k - 100k	30 + 6	60 + 5	280 + 9	70 + 5	290 + 9	80 + 5	300 + 9	5
	100k - 330k	80 + 15	280 + 5	750 + 20	300 + 5	850 + 20	350 + 5	0.1% + 20	20
	300k - 1M	130 + 30	850 + 5	0.15% + 120	980 + 5	0.17% + 120	0.1% + 5	0.2% + 120	50
1V	10 - 31	30 + 20	70	80 + 30	85	85 + 30	80	90 + 30	1.5
	32 - 330	10 + 10	20	40 + 20	25	45 + 20	30	50 + 20	1.5
	300 - 33k	7 + 5	15	30 + 10	18	35 + 10	20	40 + 10	1.5
	30k - 100k	15 + 10	35	60 + 20	40	70 + 20	50	80 + 20	1.5
	100k - 330k	30 + 20	120	385 + 100	130	395 + 100	150	405 + 100	10
	300k - 1M	100 + 20	800	0.21% + 400	900	0.22% + 400	0.1%	0.24% + 400	50
	10V	10 - 31	30 + 200	75	80 + 300	78	85 + 300	80	90 + 300
32 - 330		10 + 100	25	25 + 200	28	45 + 200	30	50 + 200	1.5
300 - 33k		7 + 50	20	20 + 100	23	35 + 100	25	40 + 100	1.5
30k - 100k		15 + 100	35	60 + 200	40	70 + 200	50	80 + 200	1.5
100k - 330k		30 + 200	120	120 + 1 mV	130	215 + 1 mV	150	250 + 1 mV	10
300k - 1M		100 + 200	760	800 + 5 mV	900	0.13% + 5 mV	0.1%	0.15% + 5 mV	50
100V		10 - 31	30 + 2 mV	75	90 + 3 mV	78	95 + 3 mV	80	100 + 3 mV
	32 - 330	10 + 1 mV	25	50 + 2 mV	28	55 + 2 mV	30	60 + 2 mV	3
	300 - 10k	10 + 400	25	40 + 1 mV	28	45 + 1 mV	30	50 + 1 mV	3
	10k - 33k	10 + 400	35	50 + 1 mV	38	55 + 1 mV	40	60 + 1 mV	3
	30k - 100k	15 + 1 mV	45	90 + 3 mV	50	105 + 3 mV	60	120 + 3 mV	5
	100k - 330k	30 + 2 mV	230	530 + 50 mV ^[6]	300	615 + 50 mV ^[6]	400	700 + 50 mV ^[6]	30
	330k - 1M	600 + 15 mV	0.57%	0.8% + 130 mV ^[6]	0.60%	0.9% + 130 mV ^[6]	0.72%	1% + 130 mV ^[6]	90
1000V	10 - 31	20 + 10 mV	120	130 + 20 mV	125	140 + 20 mV	130	150 + 20 mV	5
	32 - 330	20 + 4 mV	80	90 + 20 mV	85	95 + 20 mV	90	100 + 20 mV	5
	330 - 3.3k	20 + 4 mV	80	90 + 20 mV	85	95 + 20 mV	90	100 + 20 mV	5
	3k - 10k	20 + 4 mV	80	130 + 20 mV	85	135 + 20 mV	90	140 + 20 mV	5
	10k - 33k	30 + 4 mV	120	130 + 20 mV	125	135 + 20 mV	130	140 + 20 mV	5
	30k - 100k	50 + 20 mV	170	750 + 40 mV ^[6]	180	875 + 40 mV ^[6]	200	0.11% + 40 mV ^[6]	7

Scale Length: 9% to 200% of range (1mV to 100V ranges); 9% to 110% of range (1000V range).

Settling Time (to 100ppm of step size):
< 10s from 10Hz to 32Hz; < 3s from 33Hz to 330Hz;
< 1s above 330Hz. These figures x2 for range changes.

Max Resistive Load: Output Impedance
30w on 1mV to 100mV ranges; 50mA rms on 1V
range; 60mA rms on 10V range; 120mA rms on
100V range; 15mA rms on 1000V range, < 3kHz;
65mA rms on 1000V range, > 3kHz.

Setting Resolution: 1ppm or 100nV
Max Capacitive Load: 1000pF (1V to 100V
ranges); 300pF (1000V range).
Frequency Uncertainty: <= 100ppm for life

4808 DC Current Relative Uncertainty – (ppm OUTPUT + mA Floor)^[1]

Range	24Hr Stability ^[2]	90 Days Tcert ^[3] – 1 C	180 Days Tcert ^[3] – 5 C	365 Days Tcert ^[3] – 5 C	Temperature Coefficient ^[4]
100mA	7 + 2 nA	50 + 2 nA	75 + 2 nA	100 + 2 nA	15
1mA	3 + 8 nA	20 + 10 nA	30 + 10 nA	40 + 10 nA	6
10mA	3 + 80 nA	20 + 0.1	30 + 0.1	40 + 0.1	6
100mA	3 + 0.8	20 + 1	30 + 1	40 + 1	6
1A	7 + 20	50 + 20	75 + 20	100 + 20	15
10A ^[7]	15 + 20	50 + 500	100 + 500	150 + 500	15

Scale Length: 0 to –200% of range (100mA to 1A ranges); 0 to –100% of range (10A range).
 Settling Time: < 1s to full specification (100mA to 1A ranges); < 1s to 40ppm of step size (10A range).
 Settling Resolution: 1ppm
 Compliance Voltage: 3V on 100mA to 1A ranges; 2V on 10A range.

4808 AC Current Relative Uncertainty – (ppm OUTPUT + mA Floor)^[1]

Range	Frequency Band	24Hr Stability ^[2]	90 Days Tcert ^[3] – 1 C		180 Days Tcert ^[3] – 5 C		365 Days Tcert ^[3] – 5 C		Temperature Coefficient ^[4]
			Spot Freq	Broadband	Spot Freq	Broadband	Spot freq	Broadband	
100mA	10 - 1k	50 + 4 nA	100	120 + 6 nA	125	135 + 10 nA	130	150 + 10 nA	10
	1k - 5k	70 + 6 nA	180	250 + 8 nA	200	270 + 14 nA	220	300 + 14 nA	20
1mA	10 - 1k	30 + 20 nA	60	70 + 60 nA	80	85 + 0.1	90	100 + 0.1	10
	1k - 5k	40 + 20 nA	100	120 + 60 nA	150	160 + 0.1	160	200 + 0.1	10
10mA	10 - 1k	30 + 0.2	60	70 + 0.6	80	85 + 1	90	100 + 1	10
	1k - 5k	40 + 0.2	100	120 + 0.6	150	160 + 1	160	200 + 1	10
100mA	10 - 1k	30 + 2	60	70 + 6	80	85 + 10	90	100 + 10	10
	1k - 5k	40 + 2	100	120 + 6	150	160 + 10	160	200 + 10	10
1A	10 - 1k	50 + 40	170	250 + 60	200	275 + 100	200	300 + 100	20
	1k - 5k	70 + 60	270	400 + 80	300	425 + 140	320	450 + 140	25
10A ^[7]	10 - 1k	40 + 400	210	300 + 1.2 mA	250	350 + 1.3 mA	270	400 + 1.3 mA	13
	1k - 5k	75 + 600	300	750 + 1.5 mA	400	800 + 1.6 mA	480	850 + 1.6 mA	28
	5k - 10k	400 + 1.2 mA	0.11%	0.15% + 6 mA	0.13%	0.18% + 6 mA	0.14%	0.22% + 6 mA	50
	10k - 20k	0.2% + 3 mA	0.4%	0.54% + 32 mA	0.45%	0.63% + 32 mA	0.5%	0.72% + 32 mA	50

Scale Length: 9% to 200% of range (100mA to 1A ranges); 9% to 110% of range (10A range).
 Frequency Uncertainty: As AC Voltage.
 Max Reactive Load: 10nF, 1mH (time constant <1ms).
 Settling Time: As AC Voltage.
 Settling Resolution: 1ppm
 Compliance Voltage: 3V rms on 100mA to 1A ranges; 2V rms on 10A range.

4808 Resistance Relative Uncertainty – (ppm OUTPUT)

Range	24Hr Stability ^[2]	90 Days Tcert ^[3] – 1 C	180 Days Tcert ^[3] – 5 C	365 Days Tcert ^[3] – 5 C	Temperature Coefficient ^[4]
10 Ohm	2	10	18	25	6
100 Ohm	1	3	6	9	2
1k Ohm	1	3	6	9	2
10k Ohm	1	3	6	9	2
100k Ohm	1	3	7	10	2
1M Ohm	2	10	18	25	6
10M Ohm	2	25	38	50	10
100M Ohm	3	30	50	70	20

Display Resolution: 0.1ppm
 Connections: Programmable 2-wire/4-wire sense. Programmable remote/local guard.
 Fuse Protection: to 120V rms

- [1] All Relative Uncertainty specifications calculated to a 99% confidence level. Methods of combining uncertainty of calibration standards should comply with the requirements defined in documents ISO TAG4 and NIST Technical Note 1297.
- [2] 24Hr Stability are relative to calibration standards for same conditions between 18 C and 28 C
- [3] Tcert = temperature at certification. Factory Calibration Temperature = 23 C
- [4] Temperature Coefficient (ppm/ C) applies outside –5 Tcert bands.
- [5] For 1 mV and 10 mV ac voltage ranges multiply the floor value by 0.6 for frequencies below 300 kHz and 0.2 for frequencies > 300 kHz.
- [6] For loads >50mA add $\frac{F(\text{kHz}) \times I(\text{mA}) - 5}{75}$ ppm.
- [7] Requires Option 60 Transconductance amplifier.

4800 Series



Option 60 Transconductance Amplifier Specifications

Uncertainty Relative to Calibration Standards

Function	Range (A)	Frequency (Hz)	Uncertainty – (ppm OUTPUT + ppm FS)			Calibration Uncertainty (ppm)	Temperature Coefficient 3 C to 13 C 33 C to 43 C (– ppm OUTPUT/ C)	Total Harmonic Distortion (%)	Impedance	Compliance
			24-hour 23 C – 1 C	90-day 23 C – 1 C	1-year 23 C – 10 C					
DC Current	0 - 11.00000	—	30 + 25	50 + 25	150 + 25	30	14	—	>100kw	>2
AC Current	0.9 - 11.00000	10 - 1k	150 + 55	200 + 55	300 + 60	130 280	20 20	0.2 0.5	>2kw >2kw	>2Vrms >2Vrms
		1k - 5k	650 + 70	700 + 70	800 + 80					

General Specifications

Outputs

DC Current

Range: Zero to –11A

Settling Time: 1 second to 40ppm of step size.

AC Current

Range: 0.9A to 11A

Settling Time (to 100ppm of step size):

10Hz to 32Hz <10 seconds

32Hz to 330Hz <3 seconds

>330Hz <1second

Protection

Isolation: 100V peak between I- and chassis.

Output Protection: fully protected against open and short circuits.

Inputs

Input Impedance: 300kw //100pF

Input Protection: 240Vrms continuous.

Environment

Temperature

Operating: 0 C to +50 C

Storage: -40 C to +70 C

Humidity (non condensing)

Operating: <90% over 5 C to +30 C; <75% over 30 C to 40 C

Storage: <95% over 0 C to 50 C

Warm-up Period

2 hours.

Power

Voltage: 110/120/220/240V – 10%, 48Hz to 62Hz

Consumption: 200W

Dimensions

Height: 89mm (3.5 in.)

Width: 455mm (17.9 in.)

Depth: 420mm (16.5 in.)

Weight: 10kg (22lbs)

Safety

Designed to UL1244, IEC348, IEC1010, BS4743 requirements.

Warranty

1-year



Option 70 Wideband Amplifier Specifications

Uncertainty Relative to Calibration Standards

Output Range		Uncertainty - (% OUTPUT + mV)			Temperature Coefficient (- ppm/ C)	Traceability (%)
Volts	dBm	24-hour 23 C - 1 C	90-day 23 C - 5 C	1-year 23 C - 5 C		
1V - 3.5V	+13 to +24	0.10 + 300	0.16 + 300	0.22 + 300	50	0.05
100mV - 1V	-7 to +13	0.14 + 100	0.22 + 100	0.28 + 100	100	0.05
10mV - 100mV	-27 to -7	0.14 + 10	0.22 + 10	0.28 + 10	100	0.10
1mV - 10mV	-47 to -27	0.15 + 1	0.23 + 1	0.29 + 1	100	0.18
300mV - 1mV	-57 to -47	0.30 + 0.4	0.43 + 0.4	0.50 + 0.4	100	0.25

Wideband Amplitude Flatness

Frequency (Hz)	Frequency Resolution (Hz)	Amplitude Flatness Referenced to 1kHz - (% OUTPUT + mV)					Settling Time (seconds)	Harmonic Distortion (dB)
		1V - 3V	100mV - 1V	10mV - 100mV	1mV - 10mV	300mV - 1mV		
10 - 30	1	0.1 + 3	0.1 + 3	0.1 + 3	0.1 + 3	0.1 + 3	10	-50
30 - 100	1	0.05 + 3	0.05 + 3	0.05 + 3	0.1 + 3	0.1 + 3	3	-50
100 - 330	1	0.05 + 3	0.05 + 3	0.05 + 3	0.1 + 3	0.1 + 3	3	-50
330 - 1k	10	0.05 + 3	0.05 + 3	0.05 + 3	0.1 + 3	0.1 + 3	1	-50
1k - 3.3k	10	0.05 + 3	0.05 + 3	0.05 + 3	0.1 + 3	0.1 + 3	1	-50
3.3k - 10k	100	0.05 + 3	0.05 + 3	0.05 + 3	0.1 + 3	0.1 + 3	1	-50
10k - 33k	100	0.05 + 3	0.05 + 3	0.05 + 3	0.1 + 3	0.1 + 3	1	-50
33k - 100k	1k	0.05 + 3	0.05 + 3	0.05 + 3	0.1 + 3	0.1 + 3	1	-50
100k - 330k	1k	0.08 + 3	0.1 + 3	0.1 + 3	0.1 + 3	0.1 + 3	1	-50
330k - 2M	10k	0.08 + 3	0.12 + 3	0.12 + 3	0.12 + 3	0.13 + 3	0.5	-40
2M - 10M	100k	0.15 + 3	0.18 + 3	0.18 + 3	0.18 + 3	0.18 + 3	0.5	-40
10M - 20M	100k	0.24 + 3	0.34 + 3	0.34 + 3	0.34 + 3	0.34 + 3	0.5	-40
20M - 30M	100k	0.35 + 3	0.45 + 3	0.45 + 3	0.45 + 3	0.45 + 3	0.5	-40

General Specifications

Output

$$\text{dBm} = 10 \log \left(\frac{\text{Power}}{1\text{mW}} \right)$$

dBm reference = 50w

0dBm = 1mW across 50w = 0.22361V

Minimum Output: 300mV (-57dBm)

Protection: fully protected against continuous short circuit conditions.

Frequency

Frequency Uncertainty: -0.01%

Settling Time (to 100ppm of step size):

10Hz to 32Hz < 10 seconds

32Hz to 330Hz < 3 seconds

>330Hz < 1second

Environment

Temperature

Operating: 0 C to +50 C

Storage: -40 C to +70 C

Humidity (non condensing)

Operating: <90% over 5 C to +30 C; <75% over

30 C to 40 C

Storage: <95% over 0 C to 50 C

Warm-up Period

2 hours

Dimensions (including 4800-Series Calibrator)

Height: 222.5mm (8.75 in.)

Width: 455mm (17.9 in.)

Depth: 563mm (22.2 in.)

Weight: 43kg (95lbs)

Safety

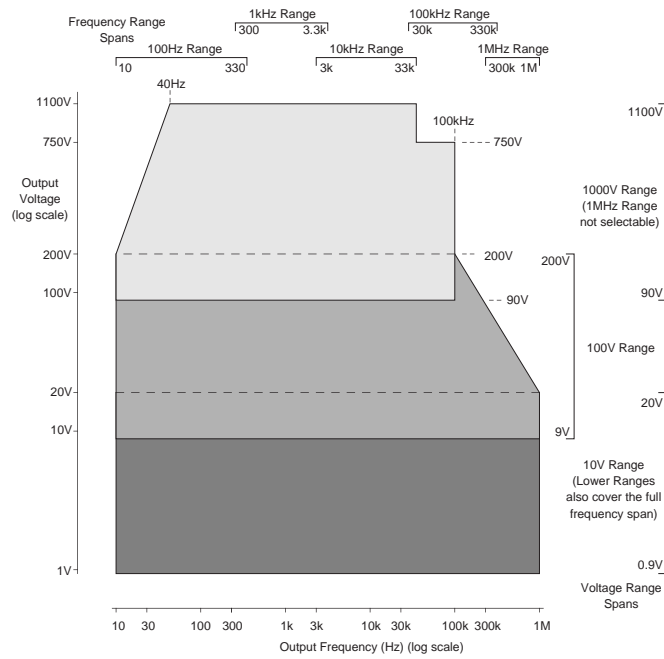
Designed to UL1244, IEC348, IEC1010, BS4743 requirements.

Warranty

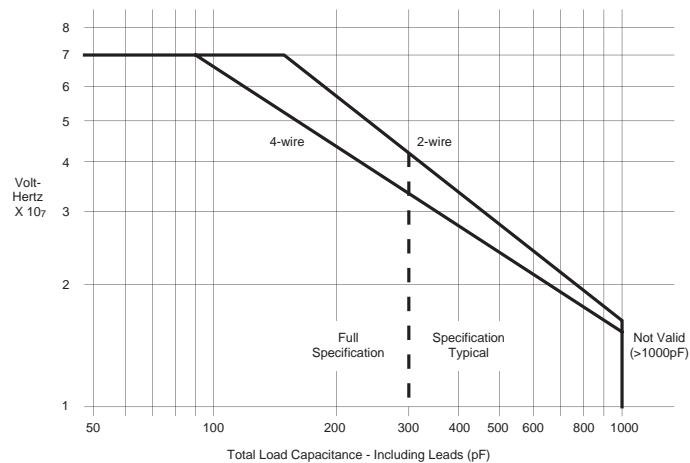
1-year

4800 Series

4800-Series Volt.Hertz Specifications



Volt.Hertz Profile



Volt.Hertz Power Limit versus Capacitive Load

General Specifications Model 4800A and Model 4808

Environment

Temperature

Operating: 0 C to +50 C

Storage: -40 C to +70 C

Humidity (non condensing)

Operating: <90% over 5 C to +30 C; <75% over 30 C to 40 C

Storage: <95% over 0 C to 50 C

Warm-up Period

2 hours.

Power

Voltage: 110/120/220/240V – 10%, 48Hz to 62Hz

Consumption: 660VA maximum (370VA typical under normal operation).

Dimensions

Height: 178mm (7 in.)

Width: 455mm (17.9 in.)

Depth: 563mm (22.2 in.)

Weight: 36kg (80lbs)

Safety

Designed to UL1244, IEC348, IEC1010, BS4743 requirements.

EMC (including options)

Emissions :

EN 50081-1:1992

EN 5022 class B

EN 55014

EN 60555-2

EN 60555-3

Immunity :

EN50082-1:1992

IEC 801-2

IEC 801-3

IEC 801-4

CE Marked

Warranty

1-year

Ordering Information

Model 4800A

Model 4800A Multifunction Calibrator

Option 60 Model 4600 Transconductance Amplifier for DC Current and/or AC Current up to 11A, complete with all connecting leads

Option 70 Wideband source to extend frequency coverage of AC Voltage to 30 MHz at voltages up to 3.5V

Option 90 Rack mounting kit

Model 4808

Model 4808 Multifunction Calibrator

Option 10 DC Voltage from zero to –200V

Option 20 AC Voltage from 90mV to 200V

Option 30 Integral high voltage amplifier for DC Voltage and/or AC Voltage up to 1100 V (requires Option 10 for DC Voltage or Option 20 for AC Voltage)

Option 40 DC Current from zero to –2A and AC Current from 9mA to 2A (requires Option 10 for DC Current or Option 20 for AC Current)

Option 50 Resistance from zero to 100Mw

Option 60 Model 4600 Transconductance Amplifier for DC Current and/or AC Current up to 11A, complete with all connecting leads (requires Option 40)

Option 70 Wideband source to extend frequency coverage of AC Voltage to 30 MHz at voltages up to 3.5V (requires Option 20)

Option 90 Rack mounting kit

System Compatible Components

Model 1516 4800-Series compatible general-purpose (DC/AC/Ohms) analog output lead-set comprising two 0.5-metre lengths of screened 2-core PTFE cable, terminated in a shrouded terminal box at one end and five 4-mm shrouded Banana plugs at the other end.

Model 4950 Multifunction Transfer Standard for on-site calibrator support (see separate Model 4950 brochure)

Portocal-II Automated calibration and inventory management software (see separate Portocal-II brochure)

For further information on other Wavetek calibration products, please call your local sales office.

Other Calibration Instruments from Wavetek

Model 9500 Oscilloscope Calibrator



High accuracy calibration of analog and digital-storage oscilloscopes up to 1 GHz.

Model 9100 Multi-Product Calibrator



Calibration of over 14 different categories of general-purpose test and measurement equipment.

Model 4950 Multi-Function Transfer Standard



Ultra-stable transfer measurements for on-site calibrator support.

Model 4920 Alternating Voltage Measurement Standard



The world's most advanced AC Voltage measuring instrument.

Model 1281 Precision Digital Multimeter



Ultra-low noise, 8-1/2 digit precision, multi-function measurements.



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