

# Model 4950

## The 4950 Multifunction Transfer Standard

- ◆ *Calibrate any manufacturer's multifunction calibrators*
- ◆ *Designed to travel - Excellent interlaboratory audit standard*
- ◆ *Automation improves productivity*
- ◆ *Controlled processes provide repeatability and reduces measurement uncertainty*

FUNCTION	TRANSFER STABILITY	
	30 day	90 day
DCV	1.5 ppm	2.1 ppm
ACV	10 ppm	14 ppm
DCI	7 ppm	9.8 ppm
ACI	40 ppm	56 ppm
Ohms	3 ppm	4.1 ppm

## A Revolution in Multifunction Calibrator Support

The dramatic improvement in the accuracy of multifunction calibrators, which are now often only three to four times less accurate than National Standards, has left calibration managers with a dilemma. How do they arrive at a cost effective calibrator support strategy which doesn't involve returning the calibrators to a cal lab, yet still meets stringent quality and traceability requirements.

Now Wavetek's Model 4950 Multifunction Transfer Standard provides the answer – because it transfers traceability between cal lab standards and several calibra-



tors without having to move the calibrators an inch. So there's no expensive down-time, and shipment costs are reduced from the cost of sending each individual calibrator back to the cal lab to that of sending a single instrument – a Model 4950.

**Accurate, Repeatable Results**

The entire process can be automated at either end of the transfer – both in the calibration laboratory and during in-place calibrator recalibration – so the accuracy and repeatability of the Model 4950's transfer measurements are assured. And because the Model 4950 allows its stability during the round trip to the cal lab to be monitored, it meets the 'best practice' requirements of the latest closed-loop calibration methodologies. Unlike other transfer standards, the Model 4950 transfers traceability directly to the calibrator's output terminals on every range of every caat up to 140 individually calibrated measurement points if necessary. So the Model 4950 will work with *any* manufacturer's calibrators, not just those with special internal calibration circuitry. And because the Model 4950 doesn't require the use of external AC/DC transfer devices or ratio dividers, the cost per cal point is surprisingly low.

Whatever mix of calibrators you have to support – from simple 4-1/2 digit units to the latest 8-1/2 digit multifunction calibrators – the Model 4950 fulfils all your traceability requirements. Add to that the enhanced confidence levels you'll enjoy by always having an instrument on-hand to check cali-

The Model 4950 is the nearest thing you'll get to a fully functional cal lab in a suitcase.



brator performance, and the Model 4950 makes sound economic sense – whether you're supporting one calibrator or a hundred.

**A Systems Approach to Traceability**

**W**hen you buy the Wavetek Model 4950 you're not only buying the best multifunction transfer instrument in the world – you're buying a complete transfer measurement system for DC voltage, AC voltage, DC current, AC current and Resistance that meets the most rigorous of traceability requirements. The closed-loop methods used by the Model 4950 already have international recognition from leading quality approval authorities, which is why major corporations in the US and Europe have chosen the 4950 as the prime link between their calibration laboratories and their shop-floor calibrators.

Everything – from the temperature, shock, and humidity recorders in the Model 4950's transit case, to the sophisticated PC software that logs the instrument's performance before and after shipment – ensures that the Model 4950 moves traceability out of the cal lab and right into your calibrators, wherever they are.

**Designed for Travel**

Specifically designed for maximum stability under transport conditions, the Model 4950 measurement circuits include no mechanical adjustments to get jarred out of place.

Instead, the tolerance of all critical components is compensated digitally, using correction factors stored in two, independent, non-volatile 'Autocal' memories. One of these is used periodically to align the 4950 to higher-order cal lab standards. The other is dedicated to assessing the 4950's own long-term performance – because when it comes to assessing the confidence level of your calibration system, history is just as important as accuracy.

# Model 4950

## Software for Total System Control

Supplied as an integral part of the Model 4950 MTS System, the PC-based 4950 MTS Control Software fully automates the transfer measurement process, both when comparing the Model 4950 to cal lab standards and when using it to carry out in-place recalibration of calibrators. Operating in a Windows™ environment, the 4950 MTS software dramatically reduces the likelihood of human error – ensuring the accuracy and repeatability of transfer measurements and the overall quality of the calibration process. DMM calibrations that consumed a day or more of a skilled calibration engineer's time can now be done automatically in a matter of hours.

The 4950 has two independent calibration stores. The 'baseline' store is used to determine successful loop closure and monitor long term drift. The 'certified' store is used during the calibration process to carry traceability between calibration laboratories.

After ensuring that transportation has had no adverse effect on its accuracy, the Model 4950 proceeds to align your calibrator to cal-lab certified performance. A delayed start capability even allows the process to be carried out overnight, during the electrically quiet hours of the early morning.

If necessary, you can modify the procedures to reflect customized calibration intervals and enter new specification limits where these

differ from the calibrator's data-sheet specifications.

And once you've captured data (via a totally automated procedure if you use the Model 4950 with a Wavetek calibrator) you can transfer it into spreadsheet programs such as Lotus 1-2-3™ or Excel™ for analysis, archiving, and report generation.

### Statistical Process Control

In the spreadsheet environment you can use Statistical Process Control (SPC) techniques to analyze the data. You'll also be able

to compare current data with that acquired during previous 4950 MTS transfer measurements, allowing you to evaluate calibrator drift rates. With this historical information at your fingertips you have the opportunity to adopt more cost effective calibration strategies – extending the calibration interval of low drift rate units, or characterizing individual calibrators for special ultra-high performance applications.



## Reliability and Support

At every step in the closed-loop calibration process we've provided comprehensive checks and operator guidance to ensure the highest confidence levels.

When you need to prepare a Model 4950 for transit to or from a certifying laboratory, comprehensive documentation guides you through every step of the procedure – from preparing the 4950 MTS for calibration to packing the instrument

in its transit case and checking its shock, vibration, and temperature excursion sensors.

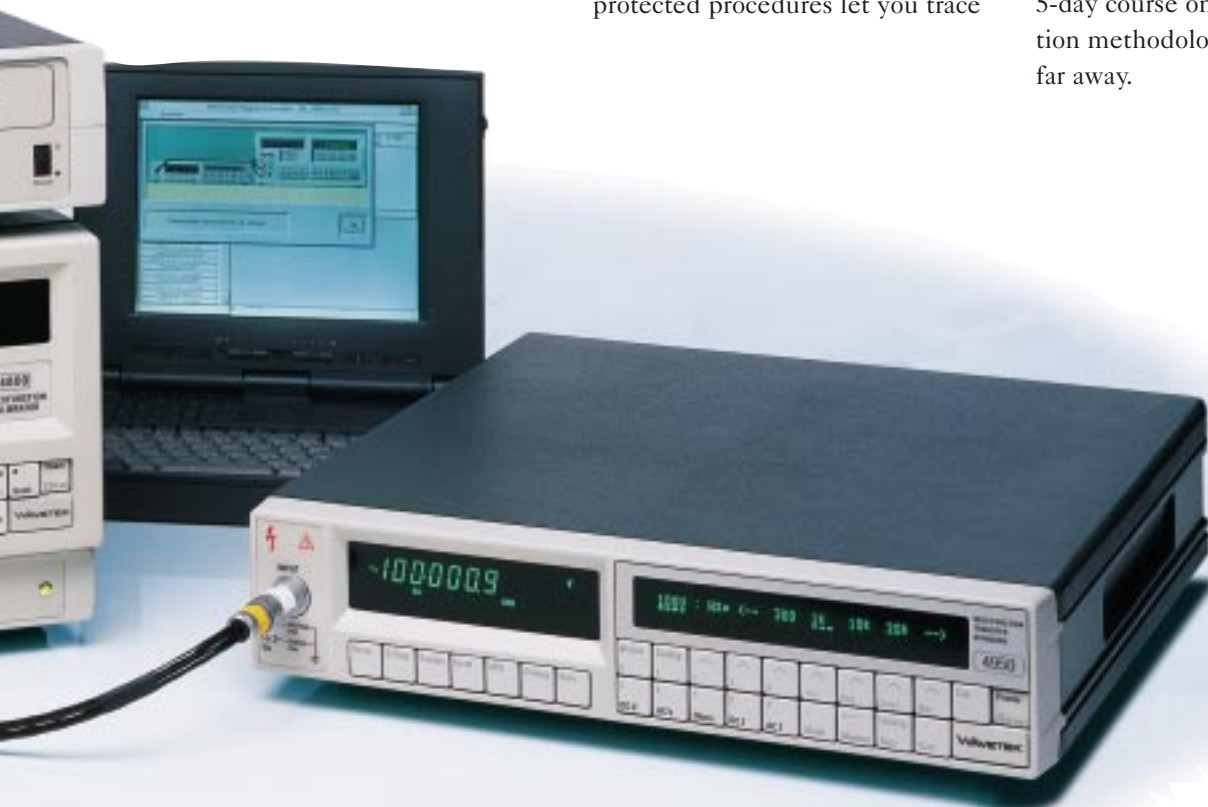
Whenever the Model 4950 is powered up, it automatically times out its own warm-up period, warning the operator against using the instrument to its full accuracy until warm-up is complete. A single key-stroke then initiates the Model 4950 self-test routine, which checks all major circuit elements for correct operation and automatically diagnoses any problems down to printed circuit board assembly level.

The 4950 MTS Control Software also has its own test and de-bug facilities built in. Password-protected procedures let you trace

all IEEE-488 bus activity and capture intermediate results data – a great help to service departments trying to locate system-level failures.

The Model 4950 is built with meticulous care from the highest grade components to ensure that it provides you with uninterrupted service. Wavetek's ISO9000 approval is proof that our in-house quality management systems meet the most exacting of standards. That's why the Model 4950 is covered by the full Wavetek warranty.

It is also supported by Wavetek Service Centers worldwide. So whatever level of support you're looking for – service and repair facilities, telephone assistance, or a 5-day course on the latest calibration methodologies – help is never far away.



The entire transfer process can be automated at both ends — in the cal lab and during in-place calibrator recalibration — so the accuracy and repeatability of the Model 4950's measurements are assured.



# Model 4950

## 4950 Specifications

Specifications are  $\pm$ ppm of reading, valid within the measurement band and within  $\pm$ 1% of all frequencies

Function	Transfer Point [1]	Frequency	Transfer Stability [2] ppm $\pm$ 1 °C TCAL		Temperature Coefficient ppm/°C [3]	MTS_CAL [4] calibration uncertainty	CAL_CAL [4] uncertainty [5] [6]		
			30 day	90 day					
DC Voltage	$\pm$ 100 mV		3	4.2	0.6	4.0	5.0		
	$\pm$ 1 V		1.5	2.1	0.5	2.2	2.6		
	$\pm$ 10 V		1.5	2.1	0.5	1.4	2.1		
	$\pm$ 19 V		1.5	2.1	0.5	1.8	2.3		
	$\pm$ 100 V		2	2.8	0.8	2.0	2.9		
	$\pm$ 100 V		2	2.8	0.8	2.0	2.9		
AC Voltage	1mV, 10mV and 100mV [7]	10 Hz	20 + 2 $\mu$ V	28 + 2 $\mu$ V	1	117	120 + 2 $\mu$ V		
		20 Hz	20 + 2 $\mu$ V	28 + 2 $\mu$ V	1	117	120 + 2 $\mu$ V		
		30 Hz	20 + 2 $\mu$ V	28 + 2 $\mu$ V	1	117	120 + 2 $\mu$ V		
		40 Hz	20 + 2 $\mu$ V	28 + 2 $\mu$ V	1	117	120 + 2 $\mu$ V		
		55 Hz	20 + 2 $\mu$ V	28 + 2 $\mu$ V	1	117	120 + 2 $\mu$ V		
		300 Hz	20 + 2 $\mu$ V	28 + 2 $\mu$ V	1	89	91 + 2 $\mu$ V		
		1 kHz	20 + 2 $\mu$ V	28 + 2 $\mu$ V	1	89	91 + 2 $\mu$ V		
		10 kHz	20 + 2 $\mu$ V	28 + 2 $\mu$ V	1	103	105 + 2 $\mu$ V		
		20 kHz	20 + 2 $\mu$ V	28 + 2 $\mu$ V	1	117	119 + 2 $\mu$ V		
		30 kHz	20 + 2 $\mu$ V	28 + 2 $\mu$ V	1	190	191 + 2 $\mu$ V		
		50 kHz	30 + 2 $\mu$ V	42 + 2 $\mu$ V	5	190	192 + 2 $\mu$ V		
		100 kHz	50 + 3 $\mu$ V	70 + 3 $\mu$ V	5	356	359 + 3 $\mu$ V		
		300 kHz	100 + 3 $\mu$ V	140 + 3 $\mu$ V	5	579	588 + 3 $\mu$ V		
		500 kHz	200 + 3 $\mu$ V	280 + 3 $\mu$ V	40	607	639 + 3 $\mu$ V		
		1 MHz	300 + 3 $\mu$ V	420 + 3 $\mu$ V	40	945	992 + 3 $\mu$ V		
		1V and 10V		10 Hz	10	14	1	36	38
				20 Hz	10	14	1	36	38
				30 Hz	10	14	1	36	38
				40 Hz	10	14	1	24	26
				55 Hz	10	14	1	24	26
				300 Hz	10	14	1	24	26
				1 kHz	10	14	1	24	26
10 kHz	10			14	1	24	26		
20 kHz	10			14	1	24	26		
30 kHz	10			14	1	26	26		
50 kHz	20			28	5	26	37		
100 kHz	30			42	5	37	47		
300 kHz	70			98	10	96	119		
500 kHz	100			140	40	202	226		
1 MHz	200			280	40	557	591		
19V	1 kHz			10	14	1	24	26	
100V		10 Hz	10	14	2	41	42		
		20 Hz	10	14	2	41	42		
		30 Hz	10	14	2	41	42		
		40 Hz	10	14	2	36	38		
		55 Hz	10	14	2	36	38		
		300 Hz	10	14	2	26	28		
		1 kHz	10	14	2	26	28		
		10 kHz	10	14	2	26	28		
		20 kHz	10	14	2	26	28		
		30 kHz	10	14	2	29	31		
		50 kHz	20	28	5	35	40		
		100 kHz	30	42	5	64	71		
		200 kHz	50	70	10	239	244		
		700V		50 kHz	50	70	8	110	121
100 kHz	50			70	8	344	348		
1000V		55 Hz	15	21	2	37	40		
		300 Hz	15	21	2	37	40		
		1 kHz	15	21	2	37	40		
		10 kHz	15	21	2	42	44		
		20 kHz	15	21	2	47	49		
		30 kHz	15	21	2	74	75		

[1] Measurements within  $\pm$ 10% of band and  $\pm$ 1% of frequency except the 190% bands.

[2] Assumes a successful 4950 transportation loop closure.

[3] Within  $\pm$ 5°C of TCAL.

[4] MTS\_CAL & CAL\_CAL refer to Wavetek automatic calibration software.

## 4950 Specifications

Function	Transfer Point [1]	Frequency	Transfer Stability [2] ppm $\pm 1^\circ\text{C}$ TCAL		Temperature Coefficient ppm/ $^\circ\text{C}$ [3]	MTS_CAL [4] calibration uncertainty	CAL_CAL [4] uncertainty [5] [6]		
			30 day	90 day					
DC Current	$\pm 100 \mu\text{A}$		7	9.8	10	20	21		
	$\pm 1 \text{ mA}$		7	9.8	10	11	13		
	$\pm 10 \text{ mA}$		7	9.8	10	11	13		
	$\pm 100 \text{ mA}$		7	9.8	10	14	16		
	$\pm 1 \text{ A}$		15	21	10	24	28		
	$\pm 10 \text{ A}$ [2]		20	28	10[2]	54	57		
AC Current	100 $\mu\text{A}$	10Hz	50	70	20	122	132		
		20Hz	50	70	20	122	132		
		30Hz	50	70	20	107	118		
		40Hz	50	70	20	85	99		
		55Hz	50	70	20	85	99		
		300Hz	50	70	20	85	99		
		1kHz	50	70	20	85	99		
		5kHz	100	140	20	129	163		
		10kHz	300	420	30	459	548		
		1 mA, 10 mA, 100 mA and 1 A [7]	10Hz	40	56	20	113	120	
	20Hz		40	56	20	113	120		
	30Hz		40	56	20	96	104		
	40Hz		40	56	20	75	85		
	55Hz		40	56	20	75	85		
	300Hz		40	56	20	75	85		
	1kHz		40	56	20	75	85		
	5kHz		70	98	20	115	134		
	10kHz		200	280	30	410	456		
	10 A [8]		10Hz	200	280	40	234	308	
		20Hz	200	280	40	234	310		
		30Hz	200	280	40	234	310		
		40Hz	200	280	40	212	292		
		55Hz	200	280	40	200	280		
		300Hz	200	280	40	200	280		
		1kHz	200	280	40	200	280		
		5kHz	300	420	50	300	395		
		10kHz	600	840	80	337	688		
		20kHz	1000	1400	120	1234	1590		
		Resistance	1 $\Omega$		20	28	1.2	7	9
			2 $\Omega$		15	21	1.2	7	9
			10 $\Omega$		5	7	1.2	7	9
	19 $\Omega$			5	7	1	7	9	
	30 $\Omega$			3	4.2	1	6	7	
100 $\Omega$			3	4.2	1	6	6.5		
190 $\Omega$			3	4.2	1	6	7		
300 $\Omega$			3	4.2	1	3	5		
1 k $\Omega$			3	4.2	1	3	4.5		
1.9 k $\Omega$			3	4.2	1	3	5		
3 k $\Omega$			3	4.2	1	3	5		
10 k $\Omega$			3	4.2	1	3	4.5		
19 k $\Omega$			3	4.2	1	3	5		
30 k $\Omega$			5	7	1	6	8		
100 k $\Omega$			5	7	1	6	7.5		
190 k $\Omega$			5	7	1	6	8		
300 k $\Omega$			8	11.2	1.5	11	14		
1 M $\Omega$			8	11.2	1.5	11	13.5		
1.9 M $\Omega$			8	11.2	1.5	11	14		
3 M $\Omega$			12	16.8	2	21	24		
10 M $\Omega$		12	16.8	2	21	23.5			
19 M $\Omega$		12	16.8	2	21	24			
30 M $\Omega$		180	252	20	82	198			
100 M $\Omega$		180	252	20	82	198			

[5] Combined uncertainties to 95% minimum confidence level for calibrator calibration assuming Model 4950 successful loop closure within 30 days.

[6] Assumes a successful 4950 transportation loop closure within the Model 4950's 30 day transfer specification.

[7] Uncertainties quoted are for the 100mV and 10mA ranges. Other uncertainties are available on request.

[8] Only when used in conjunction with the Model 4953.

## 4950 Multifunction Transfer System Ordering Information

The 4950 MTS is supplied with the following:

401009	4950 Multifunction Transfer Standard
630395	MTS Control Software
401035	Signal Input Lead
450922-1	Ruggedized Transit Case
630388	National GPIB Interface
630386	Transit Case Environmental Monitor
630393	Shock Monitor
Model 4953	10 Amp Current Shunt Kit

### Accessories

Option 80	115V/60Hz Line Operation
Option 81	115V/50Hz Line Operation
Option 90	Rack Mount Kit
Option 95	Slide Rack Mount Kit
Option 100	2-day Hands On User Training

4808FCS combines the Wavetek 4808 Multifunction Calibrator and the 4950 into one cost effective package.

Software procedures also available in Portocal II.

### General

**Line Supply:** Power supply 90V to 145V or 187V to 292V (selectable from rear panel) 46Hz to 66Hz

**Power Consumption:** 37VA maximum

**Dimensions:** (H x W x D) 88mm (3.46 ins) x 427mm (16.8 ins) x 480mm (18.9 ins)

**Weight:** 13.5kg (30lbs)

**Interface Compatibility:** IEEE 488.1 for electrical interface and IEEE 488.2 for syntax and protocols

**External Current Shunt:** A 10A current shunt (Model 4953) is available for the instrument. The characteristics of this shunt and its serial number will be entered into the 4950 during calibration

**Signal Input Lead:** A signal input lead will be provided with the instrument. The characteristics of this and its serial number will be entered into the 4950 during calibration

**Safety:** Designed to UL 1244, IEC 348

**Warranty:** 1 year

## Worldwide Sales Offices

### Austria

Wavetek Gesellschaft m.b.H.  
Postfach 13  
Elisabethstraße 36 Tel: (43) 1-214-5110  
A-2500 Baden, Austria Fax: (43) 1-214-5109

### China

Wavetek, Wandel & Goltermann  
Suite 1608, No. 35 Jinrong Street  
Xicheng District Tel: (86) 10-8809-1288  
Beijing 100032, P. R. China Fax: (86) ??????

Wavetek, Wandel & Goltermann  
Suite 1906 Central Plaza  
No.227 Huangpibeilu Road  
Shanghai 200003 Tel: (86) 21 6375 8861  
P.R. China Fax: (86) 21 6375 8865

### Germany

Wavetek, Wandel & Goltermann  
Gutenbergstrasse 2-4  
85737 Ismaning Tel: (49) 89-996-410  
Germany Fax: (49) 89-996-41160

### Hong Kong

Wavetek Hong Kong Ltd.  
3A HKPC Building  
78 Tat Chee Avenue Tel: (852) 2788-6221  
Kowloon, Hong Kong Fax: (852) 2788-6220

### Japan

Yokogawa Electric Corporation  
Measurement Division  
155 Takamuro-cho, Kofu-shi Tel: (81) 552-43-0311  
Yamanashi-ken, 400-0057 Japan Fax: (81) 552-43-0396

### Singapore

Wavetek Asia-Pacific Pte Ltd  
438B Alexandra road  
Alexandra Technopark Hex 06-07 Tel: (65) 377-3003  
Singapore 119968 Fax: (65) 377-3033

### United Kingdom

Wavetek Ltd  
Hurricane Way Tel: (44) 1603-256600  
Norwich, Norfolk NR6 6JB, U.K. Fax: (44) 1603-483670

### United States

Wavetek Corporation  
9045 Balboa Avenue Tel: (1) 619-279-2955  
San Diego, CA 92123, U.S.A. Fax: (1) 619-450-0325

**Web Site** [www.wavetek.com](http://www.wavetek.com)

WAVETEK is a registered trademark of Wavetek Corporation  
Windows is a registered trademark of Microsoft Corporation  
Lotus 1-2-3 is a registered trademark of Lotus Development Corporation

Specifications may be subject to change without notice

© Wavetek Corporation 1999