

# **742A Series**

*RESISTANCE STANDARDS*

## **Instruction Manual**

## **LIMITED WARRANTY & LIMITATION OF LIABILITY**

Each Fluke product is warranted to be free from defects in material and workmanship under normal use and service. The warranty period is one year and begins on the date of shipment. Parts, product repairs and services are warranted for 90 days. This warranty extends only to the original buyer or end-user customer of a Fluke authorized reseller, and does not apply to fuses, disposable batteries or to any product which, in Fluke's opinion, has been misused, altered, neglected or damaged by accident or abnormal conditions of operation or handling. Fluke warrants that software will operate substantially in accordance with its functional specifications for 90 days and that it has been properly recorded on non-defective media. Fluke does not warrant that software will be error free or operate without interruption.

Fluke authorized resellers shall extend this warranty on new and unused products to end-user customers only but have no authority to extend a greater or different warranty on behalf of Fluke. Warranty support is available if product is purchased through a Fluke authorized sales outlet or Buyer has paid the applicable international price. Fluke reserves the right to invoice Buyer for importation costs of repair/replacement parts when product purchased in one country is submitted for repair in another country.

Fluke's warranty obligation is limited, at Fluke's option, to refund of the purchase price, free of charge repair, or replacement of a defective product which is returned to a Fluke authorized service center within the warranty period.

To obtain warranty service, contact your nearest Fluke authorized service center or send the product, with a description of the difficulty, postage and insurance prepaid (FOB Destination), to the nearest Fluke authorized service center. Fluke assumes no risk for damage in transit. Following warranty repair, the product will be returned to Buyer, transportation prepaid (FOB Destination). If Fluke determines that the failure was caused by misuse, alteration, accident or abnormal condition of operation or handling, Fluke will provide an estimate of repair costs and obtain authorization before commencing the work. Following repair, the product will be returned to the Buyer transportation prepaid and the Buyer will be billed for the repair and return transportation charges (FOB Shipping Point).

**THIS WARRANTY IS BUYER'S SOLE AND EXCLUSIVE REMEDY AND IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. FLUKE SHALL NOT BE LIABLE FOR ANY SPECIAL, INDIRECT, INCIDENTAL OR CONSEQUENTIAL DAMAGES OR LOSSES, INCLUDING LOSS OF DATA, WHETHER ARISING FROM BREACH OF WARRANTY OR BASED ON CONTRACT, TORT, RELIANCE OR ANY OTHER THEORY.**

Since some countries or states do not allow limitation of the term of an implied warranty, or exclusion or limitation of incidental or consequential damages, the limitations and exclusions of this warranty may not apply to every buyer. If any provision of this Warranty is held invalid or unenforceable by a court of competent jurisdiction, such holding will not affect the validity or enforceability of any other provision.

Fluke Corporation  
P.O. Box 9090  
Everett WA  
98206-9090

Fluke Europe B.V.  
P.O. Box 1186  
5602 B.D. Eindhoven  
The Netherlands

## INTRODUCTION

The 742A Series are small, light, rugged resistance standards. The standards require no temperature-controlled air or oil bath. The 742A Series are well suited for use as the following:

- Working standards
- Portable transfer standards
- Calibration support for the Fluke 5700A Calibrator

Stability and temperature coefficients of the 742A Series make them ideal for easy transport to and operation in any working environment within the range of 18 to 28°C. The standards come with six-month and one-year uncertainty specifications. Depending on the accuracy required, a 742A can be recertified at intervals based on either specification.

Each 742A comes with a Report of Calibration and a rear panel label showing the measured value. The rear panel also has a Fluke Primary Standards Lab calibration label, labels that show temperature coefficient alpha and beta centered on 23°C, and the standard's serial number.

### *NOTE*

*Refer to "How Temperature Correction Factors are Calculated," further on in this manual for definitions of alpha and beta.*

## SPECIFICATIONS

Table 1 lists specifications for the available 742A Series Resistance Standards.

**Table 1. 742A Series Resistance Standard Specifications**

MODEL	NOMINAL RESISTANCE AT 23°C	TIME STABILITY STABILITY		CALIBRATION UNCERTAINTY	MAXIMUM DEVIATION FROM THE 23°C VALUE (18 TO 28°C)	MAXIMUM CURRENT (VOLTAGE)	+1 PPM ERROR ADDER WHEN CURRENT EXCEEDS THE FOLLOWING
		180 DAY	1 YEAR				
742A-1	1Ω	±5.0 ppm	±8.0 ppm	±1.0 ppm	3.0 ppm	500 mA (500 mV)	200 mA
742A-1.9	1.9Ω	±5.0 ppm	±8.0 ppm	±1.0 ppm	3.0 ppm	200 mA (380 mV)	100 mA
742A-10	10Ω	±5.0 ppm	±8.0 ppm	±1.0 ppm	3.0 ppm	100 mA (1V)	20 mA
742A-100	100Ω	±4.0 ppm	±6.0 ppm	±1.0 ppm	3.0 ppm	20 mA (2V)	5 mA
742A-1k	1 kΩ	±4.0 ppm	±6.0 ppm	±1.5 ppm	2.0 ppm	10 mA (10V)	2 mA
742A-10k	10 kΩ	±2.5 ppm	±4.0 ppm	±1.0 ppm	1.5 ppm	3 mA (30V)	600 μA
742A-19k	19 kΩ	±2.5 ppm	±4.0 ppm	±1.5 ppm	2.0 ppm	1.5 mA (28.5V)	600 μA
742A-100k	100 kΩ	±4.0 ppm	±6.0 ppm	±2.5 ppm	2.0 ppm	1 mA (100V)	400 μA
742A-1M	1 MΩ	±6.0 ppm	±8.0 ppm	±5.0 ppm	2.0 ppm	100 μA (100V)	100 μA
742A-10M	10 MΩ	±6.0 ppm	±9.0 ppm	±10.0 ppm	3.0 ppm	20 μA (200V)	20 μA
742A-19M	19 MΩ	±8.0 ppm	±10.0 ppm	±20.0 ppm	4.0 ppm	10 μA (190V)	10 μA

### GENERAL SPECIFICATIONS:

**Accuracy:** The initial resistance is trimmed to ± 2 ppm of nominal. The measured value is printed on the rear panel.

**Retrace Error (Hysteresis):** 23°C-18°C-23°C cycle: Negligible resistance shift  
 23°C-28°C-23°C cycle: Negligible resistance shift  
 23°C-0°C-23°C cycle: <2 ppm resistance shift  
 23°C-40°C-23°C cycle: <2 ppm resistance shift

**Operating Temperature Range:** 23 ±5°C

**Storage Temperature Range:** 0 to 40°C

**Report of Calibration:** The report of calibration includes a table of resistance values in 0.5° increments from 18 to 28°C.

**Size:** 8.6 cm H x 10.5 cm W x 12.7 cm L (including binding posts)  
 (3.4 in H x 4.15 in W x 5 in L (including binding posts))  
 Binding posts; 2.5 cm (1.0 in)

**Weight:** 0.68 to 0.91 kg (1.5 to 2.0 lbs), depending on model

## DESIGN AND CONSTRUCTION NOTES

The 742A Series are constructed of arrays of Fluke wirewound precision hermetically-sealed resistors. No adjustable resistors of any kind are used.

Each 742A is built with a temperature coefficient near zero at 23°C. To further reduce errors caused by temperature changes, the binding posts are constructed of low-thermal emf material.

## FEATURES

Figure 1 shows a front panel view. Figure 2 shows a rear panel view. Table 2 describes binding post functions. Table 3 describes the rear panel labels.

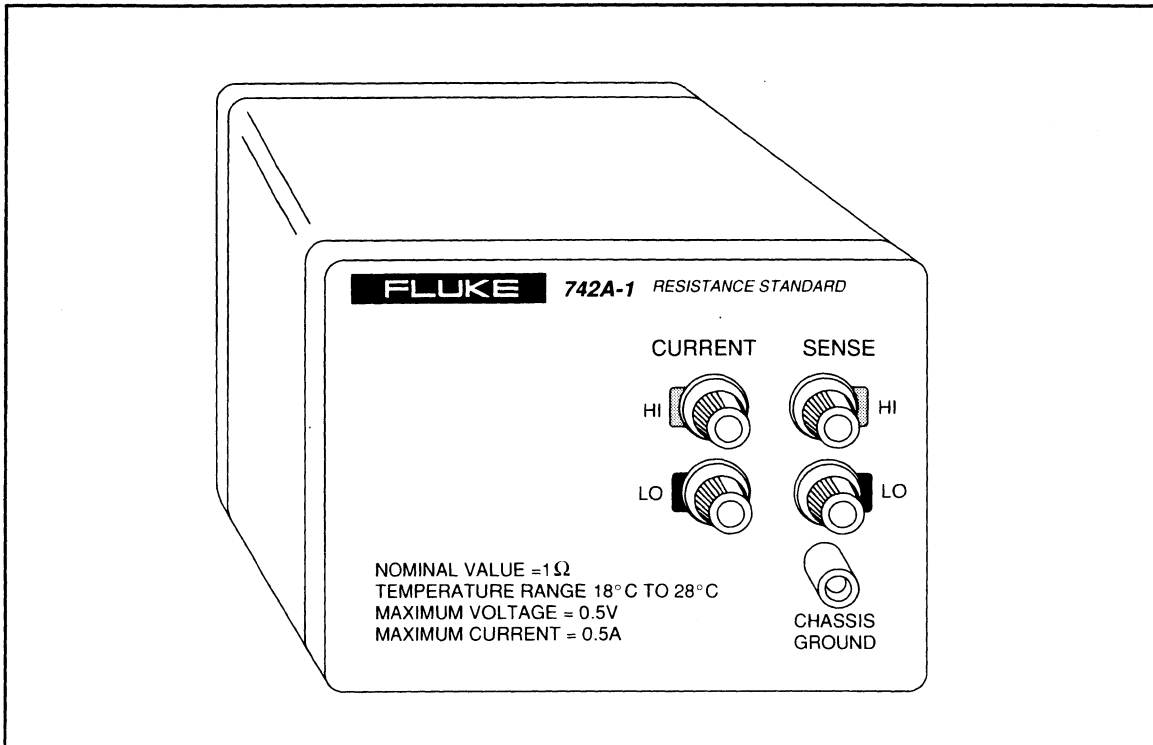
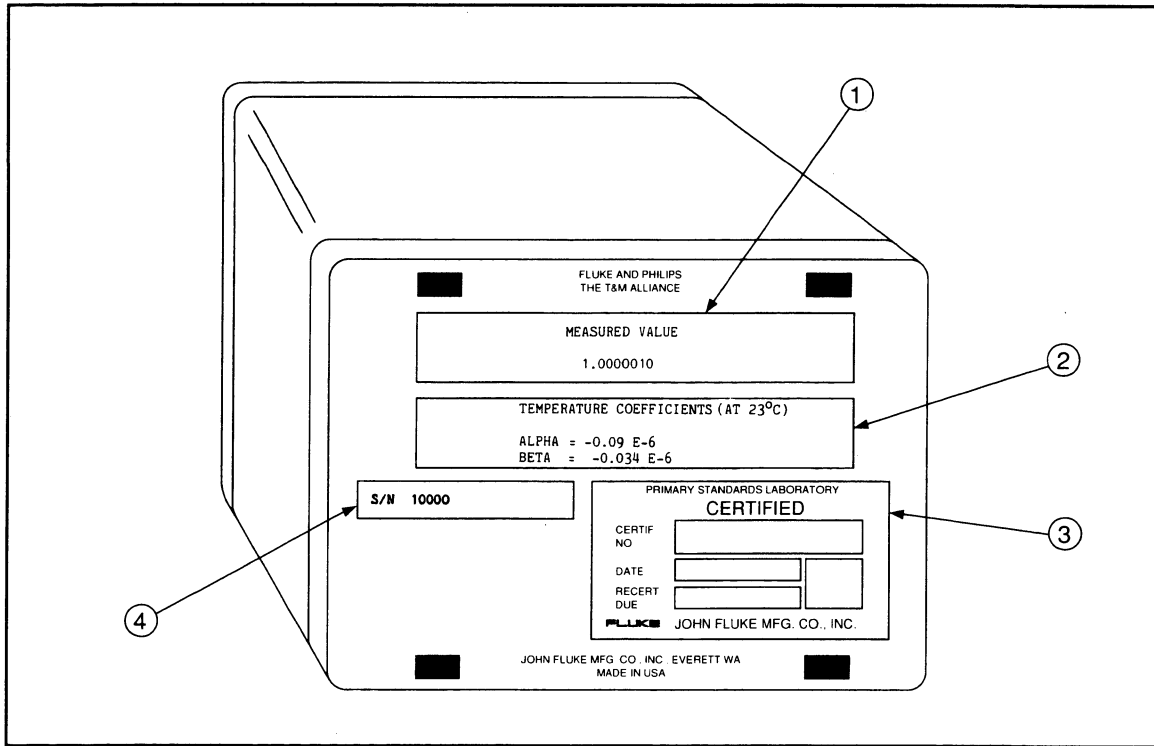


Figure 1. Typical Front Panel View

Table 2. Functions of the Binding Posts

742A BINDING POST	FUNCTION
CURRENT HI	Input for the current source from an ohmmeter
CURRENT LO	Input for the current source from an ohmmeter
SENSE HI	Measurement point for a four-wire ohmmeter
SENSE LO	Measurement point for a four-wire ohmmeter
CHASSIS GROUND	Connected to the case for shielding



**Figure 2. Typical Rear Panel View**

**Table 3. Contents of the Rear Panel Labels**

REF NO.	LABEL INFORMATION
①	Measured value label. Shows the measured value at $23 \pm 0.6^\circ$ ; the same as on the Report of Calibration.
②	Temperature coefficient label. Shows alpha and beta centered on $23^\circ\text{C}$ . Refer to "How Temperature Correction Factors are Calculated," further on in this manual for definitions of alpha and beta, and the formula to predict exact resistance at different temperatures.
③	Fluke Primary Standards Lab Calibration Label documents traceability to the U.S. National Bureau of Standards.
④	Serial number label. Shows the standard's serial number. This number and the full model number (i.e., 742A-1) positively identify a particular unit.

## OPERATING NOTES

This part of the manual explains operational and environmental considerations for the 742A Series. Follow these guidelines when operating or storing the resistance standard. Precautions for handling are under "Care and Maintenance."

### Connecting to the 742A Series

#### CAUTION

**Do not apply voltages above the maximum voltage printed on the front panel. Excessive voltage can cause a permanent shift in resistance value or damage.**

The specifications for models with CURRENT and SENSE binding posts require four-wire connections to the standard. Use these binding posts as described in Table 2.

For the case to act as a shield, the CHASSIS GROUND binding post must be connected to earth ground or instrument guard at some point in a calibration system. Normally when two or more instruments with guards are connected together, the use of a single common grounding point avoids ground loops. If applicable, ground the 742A CHASSIS GROUND binding post to that common grounding point.

Figure 3 shows a typical connection to a four-wire ohmmeter. Figure 4 shows the connection used to calibrate the 1 $\Omega$  internal resistance standard in the 5700A.

### Cable Recommendations

For optimum results, use two sets of the Fluke 5440A-7004 Low Thermal Test Leads, which are designed to reduce errors caused by thermal emfs.

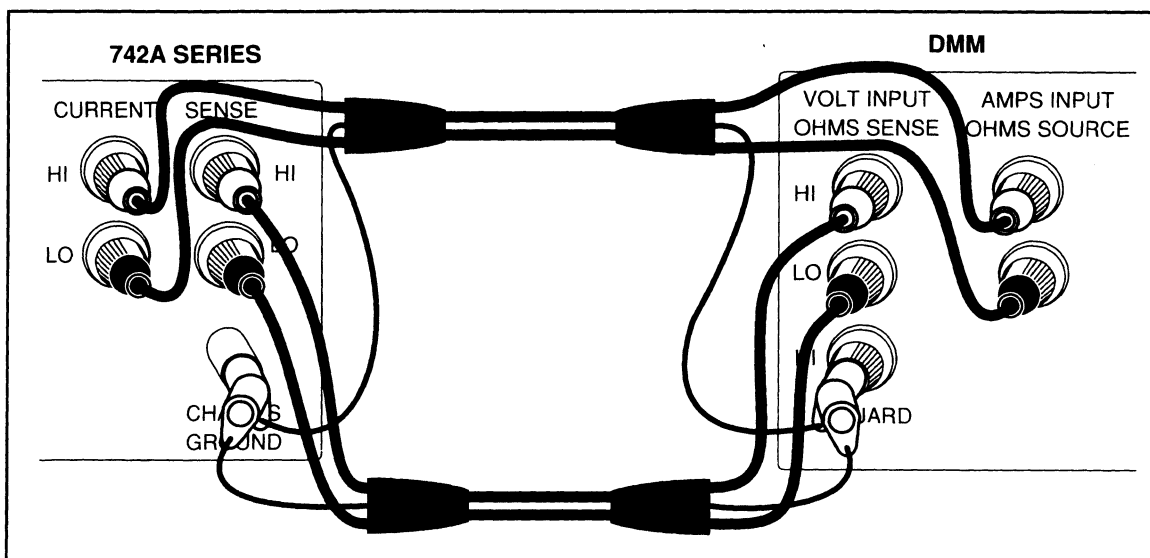


Figure 3. Connection to a Four-Wire Ohmmeter

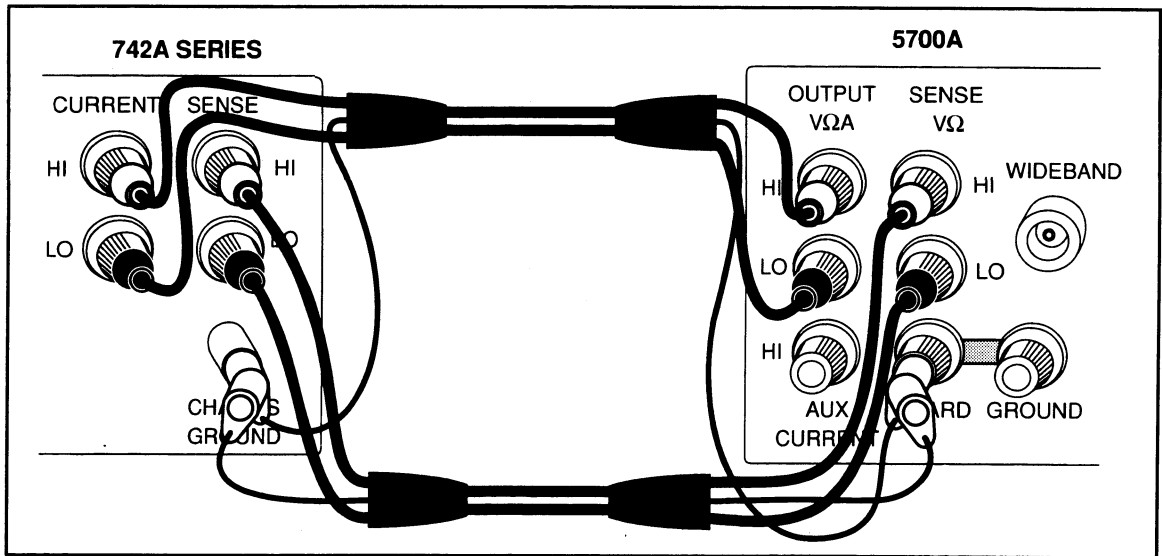


Figure 4. Connection to Calibrate the 5700A

### Operating Temperature Range

You can use the 742A Series in ambient temperatures between 18 and 28°C. To predict the deviation from nominal at temperatures other than 23°C, use the temperature characterization table provided with each unit. The table shows the calculated value and the deviation from nominal at temperatures between 18 and 28°C in half-degree increments. An example of this table is included as Table 4.

### How Temperature Correction Factors are Calculated

A label on the rear panel shows temperature coefficient factors alpha and beta centered on 23°C. (See Figure 2 for the label location.) The values of alpha and beta are individualized for each 742A. Alpha and beta are established by measurement in the Fluke Primary Standards Lab at 18°C, 23°C, and 28°C. The temperature characterization table is generated from these three measurements and the following formula:

$$R_t = R_{23} [ 1 + \alpha (t - 23) + \beta (t - 23)^2 ]$$

Where,  $R_t$  = Resistance at  $t^\circ\text{C}$   
 $R_{23}$  = Resistance at 23°C  
 $\alpha$  = Slope of the curve (ppm/°C) at 23°C  
 $\beta$  = Rate of change of slope of the curve (ppm/°C<sup>2</sup>)

$\alpha$  and  $\beta$  are constants which do not change appreciably over time and hence need to be determined only once.

In the case of the example 742A-1 used in this manual,  $\alpha$  and  $\beta$  are calculated as follows:

$$\alpha = \frac{(R_{28} - R_{18})}{\Delta t} = \frac{-0.9 \text{ E-6}}{10} = -0.09 \text{ E-6}$$

$$\beta = \frac{\left( \frac{R_{28} + R_{18}}{2} - R_{23} \right)}{\left( \frac{\Delta t}{2} \right)^2} = \frac{-0.85 \text{ E-6}}{25} = -0.034 \text{ E-6}$$

Where,  $R_{28}$  = Resistance at 28°C  
 $R_{18}$  = Resistance at 18°C  
 $R_{23}$  = Resistance at 23°C  
 $\Delta t = (28 - 18) = 10$



Table 4. Example 742A-1 Temperature Characterization Chart

Test Number: XXXX  
 Date: 04-Aug-88  
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Serial No.: XXXXXX  
 Alpha = -0.090 E-6  
 Beta = -0.034 E-6

Temp (Celsius)	Resistance ( OHMS )	Dev from nominal (in ppm)
-----	-----	-----
18.0	1.0000006	0.6
18.5	1.0000007	0.7
19.0	1.0000008	0.8
19.5	1.0000009	0.9
20.0	1.0000010	1.0
20.5	1.0000010	1.0
21.0	1.0000010	1.0
21.5	1.0000011	1.1
22.0	1.0000011	1.1
22.5	1.0000010	1.0
23.0	1.0000010	1.0
23.5	1.0000009	0.9
24.0	1.0000009	0.9
24.5	1.0000008	0.8
25.0	1.0000007	0.7
25.5	1.0000006	0.6
26.0	1.0000004	0.4
26.5	1.0000003	0.3
27.0	1.0000001	0.1
27.5	0.9999999	-0.1
28.0	0.9999997	-0.3

Figure 5 shows a graph of the value of the 742A-1 represented by the sample temperature characterization chart (Table 4). To illustrate use of the formula, calculations for resistance at 20°C and 26°C are shown. You can see that using the formula shown with alpha and beta you get the same value as in the characterization table.

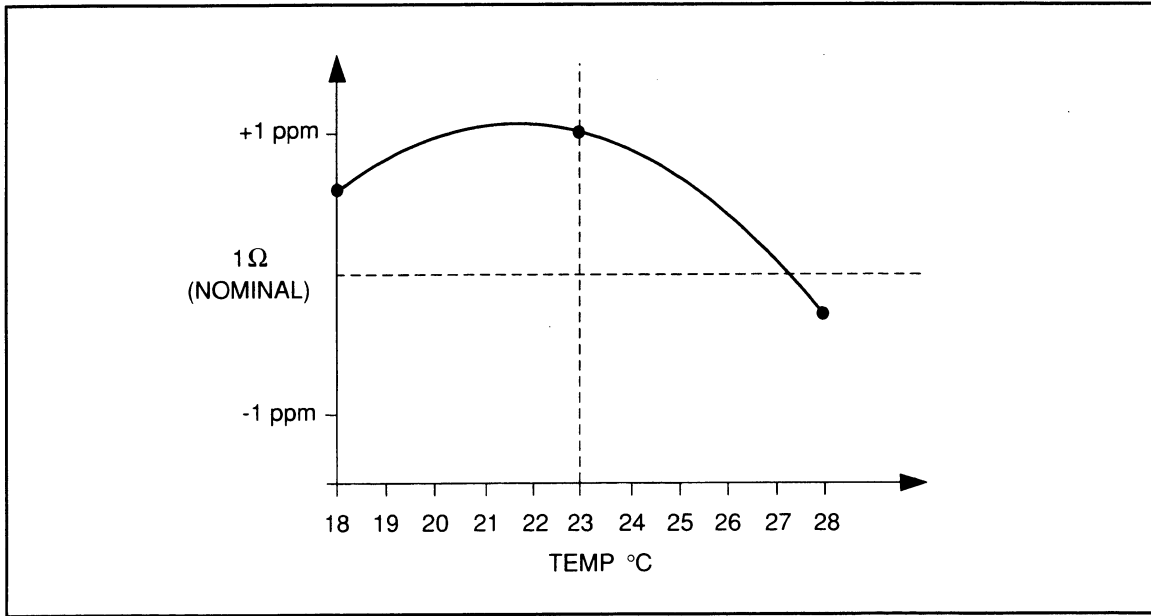


Figure 5. Graph of Resistance VS. Temperature for Sample 742A-1

$$\begin{aligned}
 R_t &= R_{23} [ 1 + \alpha (t - 23) + \beta (t - 23)^2 ] \\
 A_t &= 20^\circ\text{C}, \\
 R_{20} &= 1.0000010 [ 1 + (-0.09 \text{ E-}6) (-3) + (-0.034 \text{ E-}6) (-3)^2 ] \\
 &= 1.0000010 (1.0000003 - 0.0000003) \\
 &= 1.0000010 (1.0000000) \\
 &= 1.0000010\Omega
 \end{aligned}$$

$$\begin{aligned}
 R_t &= R_{23} [ 1 + \alpha (t - 23) + \beta (t - 23)^2 ] \\
 A_t &= 26^\circ\text{C}, \\
 R_{26} &= 1.0000010 [ 1 + (-0.09 \text{ E-}6) (3) + (-0.034 \text{ E-}6) (3)^2 ] \\
 &= 1.0000010 (1 - 0.0000003 - 0.0000003) \\
 &= 1.0000010 (1 - 0.0000006) \\
 &= 1.0000004\Omega
 \end{aligned}$$

### Storage Temperature Range

To maintain accuracy within the specified limits, do not subject the 742A Series to temperatures below 0°C or above 40°C. If exposure to temperatures outside this range is unavoidable, you can minimize the adverse effects by doing the following:

- Keep the standards in the optional transit case (Option 742A-7002). The transit case is insulated and helps protect the standards during short-term temperature extremes.
- Keep exposure to temperature extremes brief.

## **CARE AND MAINTENANCE**

The only maintenance procedure for the 742A Series is occasional cleaning. The following text gives cleaning instructions and precautions for handling.

### **Cleaning the 742A Series**

To keep the 742A Series looking like new, clean the outer surfaces using a soft cloth slightly dampened with water or a non-abrasive mild cleaning solution that does not harm plastics.

### **CAUTION**

**Do not use aromatic hydrocarbons or chlorinated solvents for cleaning. They can damage the plastic materials used in the resistance standard.**

### **Precautions for Handling**

The 742A Series are designed for mechanical stability, but do not abuse the standard with excessive shock. Avoid temperature extremes as mentioned under "Storage Temperature Range". When you transport the standard, it is recommended that you use the Option 742A-7002 Transit Case for shock and temperature protection. The case holds two 742A Series Resistance Standards.

## **SERVICING INFORMATION**

Because the 742A Series are certified and non-adjustable resistance standards, they are considered non-user repairable. If the unit is damaged, it must be returned to the factory for repair and recalibration.

## **RECERTIFICATION**

For recertification, send the resistance standard to a Fluke technical center. For a nominal fee, Fluke will remeasure and recertify the value of your 742A based on comparison to standards traceable to the U.S. National Bureau of Standards. A new temperature characterization chart is provided on recertification. If you wish, you can record the changes at each recertification and use this data to more closely predict the performance of your 742A. A list of sales and service centers is located near the end of this manual.



## Service Centers

### USA

#### California

FLW  
Fluke Calibration Center  
C/o FLW Service Corporation  
3505 Cadillac Ave., Bldg E  
Costa Mesa, CA 92626  
TEL: (714) 751-7512  
FAX: (714) 755-7332

#### Dallas

Fluke Service Center  
2104 Hutton Drive  
Suite 112  
Carrollton, TX 75006  
TEL: (214) 406-1000  
FAX: (214) 247-5642

Fluke Service Center  
42711 Lawrence Place  
Fremont, CA 94538  
TEL: (510) 651-5112  
FAX: (510) 651-4962

#### Illinois

Fluke Service Center  
1150 W. Euclid Avenue  
Palatine, IL 60067  
TEL: (708) 705-0500  
FAX: (847) 705-9989

#### New Jersey

Fluke Service Center  
W. 75 Century Rd  
Paramus, N.J. 07652-0930  
TEL: (201) 599-9500 (599-0919)  
FAX: (201) 599-2093

#### Washington

Fluke Service Center  
Fluke Corporation  
Building #4  
1420 - 75TH St. S.W.  
Everett WA 98203  
TEL: (206) 356-5560  
FAX: (206) 356-6390

### INTERNATIONAL

#### Australia

Phillips Sci. and Ind., Pty., L.  
745 Springvale Road  
Mulgrave  
Victoria 3170  
TEL: 61-3-881-3666  
FAX: 61-3-881-3636

Phil. Sci. & Ind. Blk F, Centrect.  
34 Waterloo Road  
North Ryde, N.S.W. 2113  
TEL: 61-2-888-8222  
FAX: 61-2-888-0440

#### Austria

Fluke Vertriebsges. GMBH (GM)  
SudrandstraBe 7  
P.O. Box 10, A-1232 Vienna  
TEL: 43-1-614-100  
FAX: 43-1-614-1010

#### Bahrain

Mohammed Fakhroo & Bros.  
P.O. Box 439  
Bahrain  
TEL: 973-253529  
FAX: 973-275996

#### Belgium

N.V. Fluke Belgium S.A.  
Sales & Service Dept.  
Langeveldpark - Unit 5 & 7  
P.Basteleusstraat 2-4-6  
1600 St. Pieters - Leeuw  
TEL: 218-2-331-2777 (ext 218)  
FAX: 32-2-331-1489

#### Bolivia

Casilla 7295,  
Calle Ayacucho No. 208  
Edificio Flores, 5to. Piso  
La Paz, Bolivia  
TEL: 591-2-317531 or 317173  
FAX: 591-2-317545

#### Brazil

Philips Medical Systems, LTDA  
Av. Interlagos North  
3493 - Campo Grande  
04661-200 Sao Paulo S.P.  
TEL: 55-11-523-4811  
FAX: 55-11-524-4873 (ID 2148)

Sigtron Instrumentos E. Servicos  
Rua Alvaro Rodrigues  
269 - Brooklin  
Sao Paulo, Sp  
TEL: 55-11-240-7359  
FAX: 55-11-533-3749

Sistest  
Sist. Instr. Testes Ltda  
Av. Ataulfo De Paiva  
135 S/ 1117 - Leblon 22.449-900  
Rio De Janeiro, Rj, Brazil  
TEL: 55-21-259-5755 or 512-3679  
FAX: 55-21-259-5743

#### Bulgaria

Ac Sophico, Cust. Supp. Serv.  
P.O. Box 42  
1309 Sofia, Bulgaria  
TEL: 359-2-200785  
FAX: 359-2-220910

#### C.S.F.R.

Elsco  
NA. Berance 2  
16200 Praque 6  
TEL: 42-2-316-4810  
FAX: 42-2-364986

#### Data Elektronik BRNO

Jugoslavska 113  
61300 Brno  
TEL: 42-5-57400-2  
FAX: 42-5-574002

#### Canada

Fluke Electronics Canada Inc.  
400 Britannia Rd East, Ut #1  
Mississauga, Ontario  
L4Z 1X9  
TEL: 905-890-7600  
FAX: 905-890-6866

#### Chile

Intronica, Instrumen Electronica,  
S.A.C.I.  
Guardia Vieja 181 Of. 503  
Casilla 16500, Santiago 9  
TEL: 56-2-232-6700

#### China

Fluke S.C., Room 2111  
Scite Tower  
Jianguomenwai Dajie  
Beijing 100004, PRC  
TEL: 86-10-512-6351, 6319, 3437  
FAX: 86-10-512-3437

#### Colombia

Sistemas E Instrument., Ltda.  
Calle 83, No. 37-07  
Po Box 29583  
Santa Fe De Bogota  
TEL: 57-1-287-5424  
FAX: 57-1-218-2660

#### Costa Rica

Electronic Engineering, S.A.  
Carretera de Circunvalacion  
Sabanilla Av. Novena  
P.O. Box 4300-1000, San Jose  
TEL: 506-253-3759 or 225-8793  
FAX: 506-225-1286

#### Croatia

Kaltim - Zagreb  
Fluke Sis & Serv. Draga 8  
41425 Sveta Jana  
TEL: 385-41-837115  
FAX: 385-41-837237

#### Denmark

Fluke Danmark A/S, Cust. Supp.  
Ejby Industrivej 40  
DK 2600 Glostrup  
TEL: 45-43-44-1900 or 1935  
FAX: 45-43-43-9192

#### Ecuador

Protoco Coasin Cia., Ltda.  
Av. 12 de Octubre 2449 y  
Orellana  
P.O. Box 17-03-228-A, Quito  
TEL: 593-2-230283 or 520005  
FAX: 593-2-561980

#### Egypt

EEMCO  
Electronic Equipment Mking Co.  
9 Hassan Mazher St.  
P.O. Box 2009  
St. Heliopolis 11361  
Cairo, Egypt  
TEL: 20-2-417-8296  
FAX: 20-2-417-8296

#### Fed. Rep. of Germany

Fluke Deutschland GmbH  
Customer Support Services  
Servicestutzpunkt VFN5  
Oskar-Messter-Strasse 18  
85737 Ismaning/Munich  
TEL: 49-89-9961-1260  
FAX: 49-89-9961-1270

Fluke Deutschland  
(CSS), Servicestutzpunkt VFN5  
Meiendorfer Strasse 205  
22145 Hamburg  
TEL: 49-40-679-6434  
FAX: 49-40-679-7653

#### Finland

Fluke Finland Oy  
Sinikalliontie 3, P.L. 151  
SF 02631 Espoo  
TEL: 358-0-6152-5600  
FAX: 358-0-6152-5630

#### France

Fluke France S.A.  
37 Rue Voltaire  
BP 112, 93700 Drancy, Cedex  
TEL: 33-1-4896-6300  
FAX: 33-1-4896-6330

#### Greece

Philips S.A. Hellenique  
Fluke Sales & Service Manager  
15, 25th March Street, P.O. Box  
3153, 177 78 Tavros Athens  
TEL: 30-1-489-4911 or 4262  
FAX: 30-1-481-8594

#### Hong Kong

Schmidt & Co, Ltd. 1st Floor  
323 Jaffe Road  
Wanchai  
TEL: 852-9223-5623  
FAX: 852 834-1848

#### Hungary

MTA MMSZ KFT, Srv. / Gen. Mgr  
Etele Ut. 59-61  
P.O. Box 58  
H 1502 Budapest  
TEL: 361-186-9589 or 209-3444  
FAX: 361-161-1021

#### Iceland

Taeknival HF  
P.O. Box 8294, Skeifunni 17  
128 Reykjavik  
TEL: 354-1-681665  
FAX: 354-1-680664

#### India

Hinditron Services Pvt. Inc.  
33/44A 8th Main Road  
Raj Mahal Vilas Extension  
Bangalore 560 080  
TEL: 91-80-334-8266 or 0068  
FAX: 91-33-247-6844

Hinditron Services Pvt. Ltd  
Hinditron House, 23-B  
Mahal Industrial Estate  
Mahakali Caves Rd, Andheri East  
Bombay 400 093  
TEL: 91-22-836-4560, 6590  
FAX: 91-22-836-4682

Hinditron Services Pvt. Ltd  
Castle House, 5th Floor  
5/1 A, Hungerford Street  
Calcutta 700 017  
TEL: 91-33-400-194  
FAX: 91-33-247-6844

Hinditron Services Pvt. Ltd  
204-206 Hemkunt Tower  
98 Nehru Place  
New Delhi 110 019  
TEL: 91-11-641-3675 or 643-0519  
FAX: 91-11-642-9118

Hinditron Services Pvt. Ltd.  
Field Service Center  
Emerald House, 5th Floor  
114 Sarojini Devi Road  
Secunderabad 500 003  
TEL: 91 40-844033 or 843753  
FAX: 91-40-847585

#### Indonesia

P. T. Daeng Bro, Phillips House  
J/n H.R. Rasuna Said Kav. 3-4  
Jakarta 12950  
TEL: 62-21-520-1122  
FAX: 62-21-520-5189 or 62-21-520-5189

#### Israel

R.D.T Equipment & Sys, Ltd.  
P.O. Box 58072  
Tel-Aviv 61580  
TEL: 972-3-645-0745  
FAX: 972-3-647-8908

#### Italy

Fluke Italia S.R.L., CSS  
Viale Delle Industrie, 11  
20090 Vimodrone (MI)  
TEL: 39-2-268-434-203 or 4341  
FAX: 39-2-250-1645

## Service Centers (cont)

### Japan

Fluke Corp., Sumitomo Higashi  
Shinbashi Bldg.  
1-1-11 Hamamatsucho  
Minato-ku, Tokyo 105  
TEL: 81-3-3434-0188 or 0181  
FAX: 81-3-3434-0170

### Kenya

Walterfang  
P.O. Box 14897  
Nairobi, Kenya  
TEL: 254-2  
FAX: 254-2

### Korea

B&P International Co., Ltd.  
Geopung Town A-303  
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#### **Philips (Tanzania) Ltd.**

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#### **Philips Electrical Co. of Thailand Ltd.**

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TLX: 87327 PHILTHA TH

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#### **Philips Middle East**

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#### **Industrias Philips del Uruguay S.A.**

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### **Venezuela**

#### **Coasin C.A.**

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### **Inds. Venezolanas Philips S.A.**

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### **Zaire**

#### **Philips Electronics S.A.R.L.**

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TLX: 21078 KINSHASA

### **Zambia**

#### **Philips Electrical Zambia Ltd.**

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TLX: Za 41220

### **Zimbabwe**

#### **Philips Electrical (Pvt.) Ltd.**

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### **For other countries not listed above:**

#### **Philips Export B.V.**

#### **I&E Export**

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