

Agilent 42100A Four-Terminal Pair Resistor Set

Operation and Service Manual

Third Edition

SERIAL NUMBERS

**This manual applies directly to an Agilent 42100A with serial number prefix 2950J.
For additional important information about serial numbers, read UNITS COVERED BY THIS MANUAL
in chapter 1 of this manual.**



Agilent Technologies

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Manual Printing History

The manual's printing date and part number indicate its current edition. The printing date changes when a new edition is printed. (Minor corrections and updates that are incorporated at reprint do not cause the date to change.) The manual part number changes when extensive technical changes are incorporated.

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Safety Summary

The following general safety precautions must be observed during all phases of operation, service, and repair of this instrument. Failure to comply with these precautions or with specific WARNINGS elsewhere in this manual may impair the protection provided by the equipment. In addition it violates safety standards of design, manufacture, and intended use of the instrument.

Agilent Technologies assumes no liability for the customer's failure to comply with these requirements.

- Ground The Instrument

To avoid electric shock hazard, the instrument chassis and cabinet must be connected to a safety earth ground by the supplied power cable with earth blade.

- DO NOT Operate In An Explosive Atmosphere

Do not operate the instrument in the presence of flammable gasses or fumes. Operation of any electrical instrument in such an environment constitutes a definite safety hazard.

Operating personnel must not remove instrument covers. Component replacement and internal adjustments must be made by qualified maintenance personnel. Do not replace components with the power cable connected. Under certain conditions, dangerous voltages may exist even with the power cable removed. To avoid injuries, always disconnect power and discharge circuits before touching them.

- **DO NOT Service Or Adjust Alone**

Do not attempt internal service or adjustment unless another person, capable of rendering first aid and resuscitation, is present.

- **DO NOT Substitute Parts Or Modify Instrument**

Because of the danger of introducing additional hazards, do not install substitute parts or perform unauthorized modifications to the instrument. Return the instrument to a Agilent Technologies Sales and Service Office for service and repair to ensure that safety features are maintained.

- **Dangerous Procedure Warnings**

Warnings, such as the example below, precede potentially dangerous procedures throughout this manual. Instructions contained in the warnings must be followed.

WARNING

Dangerous voltages, capable of causing death, are presenting this instrument. Use extreme caution when handling, testing, and adjusting this instrument.

Certification

Agilent Technologies certifies that this product met its published specifications at the time of shipment from the factory. Agilent Technologies further certifies that its calibration measurements are traceable to the United States National Institute of Standards and Technology, to the extent allowed by the Institution's calibration facility, or to the calibration facilities of other International Standards Organization members.

Warranty

This Agilent Technologies instrument product is warranted against defects in material and workmanship for a period corresponding to the individual warranty periods of its component products. Instruments are warranted for a period of one year. Fixtures and adapters are warranted for a period of 90 days. During the warranty period, Agilent Technologies Company will, at its option, either repair or replace products that prove to be defective.

For warranty service or repair, this product must be returned to a service facility designated by Agilent Technologies. Buyer shall prepay shipping charges to Agilent Technologies and Agilent Technologies shall pay shipping charges to return the product to Buyer. However, Buyer shall pay all shipping charges, duties, and taxes for products returned to Agilent Technologies from another country.

Agilent Technologies warrants that its software and firmware designated by Agilent Technologies for use with an instrument will execute its programming instruction when properly installed on that instrument. Agilent Technologies does not warrant that the operation of the instrument, or software, or firmware will be uninterrupted or error free.

Limitation of Warranty

The foregoing warranty shall not apply to defects resulting from improper or inadequate maintenance by Buyer, Buyer-supplied software or interfacing, unauthorized modification or misuse, operation outside the environmental specifications for the product, or improper site preparation or maintenance.

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Assistance

Product maintenance agreements and other customer assistance agreements are available for Agilent Technologies products.

For any assistance, contact your nearest Agilent Technologies Sales and Service Office. Addresses are provided at the back of this manual.

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GENERAL INFORMATION

INTRODUCTION

This operation and service manual provides the information necessary to use the HP 42100A Four-Terminal Pair Resistor Set. A pictorial figure of the HP 42100A is shown on the front cover.

DESCRIPTION

The HP 42100A is designed for performance testing and adjustment of HP's four-terminal pair type LCR meters and HP's four-terminal pair type impedance analyzers. The HP 42100A is applicable to instruments (LCR meters and impedance analyzers) which recommend using the HP 42100A in the manual of the instrument.

The HP 42100A consists of five resistors (10 Ω , 100 Ω , 1k Ω , 10k Ω , 100k Ω), an OPEN termination, and a SHORT termination.

Each resistor and each termination has four BNC male terminals of the four-terminal pair configuration.

The state-of-the-art four-terminal pair configuration of the HP 42100A insures:

- Excellent Frequency Characteristics
- Low residual inductance and stray capacitance

CONTENTS

Table 1-1 lists the contents in the HP 42100A Four-Terminal Pair Resistor Set.

Table 1-1. Contents of the HP 42100A

Description	Parts Number	Qty
OPEN Termination	HP 42090A	1
SHORT Termination	HP 42091A	1
10 Ω Resistor	HP 42101A	1
100 Ω Resistor	HP 42102A	1
1k Ω Resistor	HP 42103A	1
10k Ω Resistor	HP 42104A	1
100k Ω Resistor	HP 42105A	1
Carrying Case	PN 42100-60001	1
Operation and Service Manual	PN 42100-90000	1

SPECIFICATIONS

Complete specifications for the HP 42100A are listed in Table 1-2. The HP 42100A meets all of the specifications listed in Table 1-2 when shipped from the factory.

The supplemental specifications for the HP 42100A Four-Terminal Resistor Set are listed in Table 1-3. Supplemental specifications are not guaranteed.

Table 1-2. HP 42100A Specifications

MODEL RESISTANCE	HP 42101A 10 Ω	HP 42102A 100 Ω	HP 42103A 1k Ω	HP 42104A 10k Ω	HP 42105A 100k Ω
ACCURACY	$\pm 1\%$ at DC *1				
DIMENSION	352(W) x 104(H) x 278(D) [mm]				
WEIGHT	120g each Set of 7 (HP 42100A) + Carrying Case: approx. 2.2kg				

*1: specified at 23 °C $\pm$ 5°C, 50 % $\pm$ 20 % RH

Table 1-3. Supplemental Performance Characteristics

Maximum Power Rating	0.1 W at 70 °C
Temperature Coefficient (0 °C to 70 °C)	< 10 ppm/°C *1
Thermal Resistance (Typical)	50 °C/W
DCR Short Term Stability	< 100 ppm/day *2

*1: < 20 ppm/°C for HP 42101A 10 Ω resistor

*2: specified at 23°C $\pm$ 5°C, 50% $\pm$ 20% RH

OPERATION

The HP 42100A is used for the OPEN/SHORT error correction procedure preceding a measurement, performance testing, or adjusting the applicable instrument. The exact procedure depends on the instrument, and described in the manual of each instrument.

RESISTORS

The HP 42100A's five resistors are measured to temporarily obtain their accurate values preceding the performance testing and the adjustments of the applicable instruments. The long term stability of the HP 42100A isn't specified. Therefore the measurement procedure to obtain the values of the resistors must be performed just preceding the performance testing, or adjusting the applicable instruments. The measurement procedure is given in the manual of each instrument.

UNITS COVERED BY THIS MANUAL

Hewlett-Packard uses a two-part, nine character serial number which is stamped on the serial number plate (see Figure 1-1) attached on the each instrument (Termination or Resistor). The first four digits and a letter are the prefix and the last five digits are the suffix of the serial number. The letter in the serial number identified the country where the instrument was manufactured. The prefix is same for all identical instruments, it changes only when a change is made to the instrument. The suffix, however, is assigned sequentially and is different for each instrument. This manual applies to instruments with serial number prefixes listed under *Serial Number* on the title page.



Figure 1-1. Serial Number Plate

Units manufactured after this manual was printed may have a serial number prefix which is not listed on the title page. An unlisted serial number prefix indicates that the instrument may be different from those described in this manual. The manuals for instruments may be accompanied by a yellow Manual Changes supplement, or have a different part number. This supplement contains *Change Information* explaining how to adapt this manual to a newer resistor set.

In addition to change information, the supplement may contain information for correcting errors (Errata) in previous manuals. To keep this manual as current and accurate as possible, Hewlett-Packard recommends that you periodically request the latest Manual Change supplements. The supplement for this manual is identified by the *Print Date* and *Part Number*, both of which appear on this manual's title page.

For information concerning the serial number prefixes not listed on the title page or in the Manual Changes supplements, contact the nearest Hewlett-Packard Sales office.

INSTALLATION

INTRODUCTION

This section provides the installation instructions for the HP 42100A.

INCOMING INSPECTION

The HP 42100A meets all of the specifications listed in Table 1-2 and is carefully inspected for damage when shipped from factory. Upon receipt, inspect the HP 42100A in accordance with the following procedures.

- Inspect the shipping container for damage, and keep the shipping materials until the inspection is completed.
- Verify that the shipping container contains everything shown in Table 1-1
- Inspect the exterior of the HP 42100A for any signs of damage.
- Complete the Verification Check in accordance with Chapter 3 in this manual.

If anything is missing, damaged (scratched, dents, etc.), or if the verification check fails, notify the nearest Hewlett-Packard Sales office (see the list at the back of this manual). The Sales Office will immediately arrange for repair or replacement without waiting for a claim settlement.

STORAGE ENVIRONMENT

The HP 42100A may be stored or shipped under the following environmental conditions listed in Table 2-1.

Table 2-1. Storage Environment

Temperature	-40 °C to +70 °C
Humidity	< 95 % RH at +40 °C

The unit must be protected from temperature extremes which can cause condensation.

PACKING

ORIGINAL PACKING

Containers and packing material identical to those used in factory packing are available from Hewlett-Packard. If the unit is being returned to Hewlett-Packard for servicing, attach a tag indicating the type of service required, return address, model number, and full serial number.

OTHER PACKING

The following general instructions should be used for repacking with commercially available materials:

- Wrap the unit in heavy paper or plastic. If shipping to a Hewlett-Packard Sales Office or Service Center, attach a tag indicating the type of service required, return address, model number, and full serial number.
- Use a strong shipping container. A double-walled carton made of 350 pound test material is adequate.
- Use enough shock absorbing material (a 3 to 4 inch layer) around all sides of the unit to provide a firm cushion and to prevent the unit from moving inside the container.
- Seal the shipping container securely.
- Mark the shipping container *FRAGILE* to ensure careful handling.
- In any correspondence, refer to unit by its model number, and the full serial number.

VERIFICATION CHECK

INTRODUCTION

This section contains the basic operational check-out procedures for the HP 42100A.

The verification check is typically used for the incoming inspection or the post repair checking, and it is also performed when a HP 42100A's termination or resistor is suspected to be defective.

RECOMMENDED EQUIPMENT

Table 3-1 lists the recommended equipment to perform the HP 42100A's verification check. Equipment that meets or exceeds the critical specifications listed in Table 3-1 may be used as a substitute for the recommended models. The equipment used for the verification check must be calibrated.

Table 3-1. Recommended Equipment for Verification Check

Equipment	Critical Specifications	Qty	Recommended Model
Multimeter	Resistance Measurement Range at DC 10 Ω to 100 k Ω Accuracy 0.25 %	1	HP 3458A
Cable	BNC(m) to BNC(m) Cable	4	PN 8120-1838
Adapter	Coax BNC(f) to Coax BNC(f)	4	PN 1250-0080
	Coax BNC(f) to Banana Plug (m)	4	PN 1250-1786

VERIFICATION CYCLE

The verification check is typically performed after the HP 42100A's repair, or when a HP 42100A's termination or resistor is suspected to be defective. The HP 42100A doesn't have calibration values. Therefore, any periodic verification check or periodic calibration are not required.

OPEN and SHORT VERIFICATION CHECK

This verification check confirms the continuity/no continuity across two terminals: Hcur-Hpot, Hpot-Lpot, and Lpot-Lcur of each termination (OPEN or SHORT). The recommended check limit for the continuity/no continuity are listed in Table 3-2.

Table 3-2. Verification Check Limit of OPEN and SHORT

TERMINATION	OPEN	SHORT
Resistance between Hcur-Hpot	< 1 Ω	< 1 Ω
Resistance between Hpot-Lpot	> 1M Ω	< 1 Ω
Resistance between Lpot-Lcur	< 1 Ω	< 1 Ω

REQUIRED EQUIPMENT

Multimeter	HP 3458A (recommended)
Cable	BNC(m) to BNC (m) Cable (2EA)
Adapter	BNC(m) to Banana Plug Adapter (2EA)
	BNC(m) to BNC(m) Adapter (2EA)

PROCEDURES for OPEN

1. Set the multimeter to the 2-Wire resistance measurement mode.
2. Connect the multimeter to Hcur and Hpot of the OPEN termination as shown in Figure 3-1 (1).
3. Check that the multimeter's reading is less than 1 Ω .
4. Connect the multimeter to Hpot and Lpot of the OPEN termination as shown in Figure 3-1 (2).
5. Check that the multimeter's reading is greater than 1M Ω .
6. Connect the multimeter to Lpot and Lcur of the OPEN termination as shown in Figure 3-1 (3).
7. Check that the multimeter's reading is less than 1 Ω .

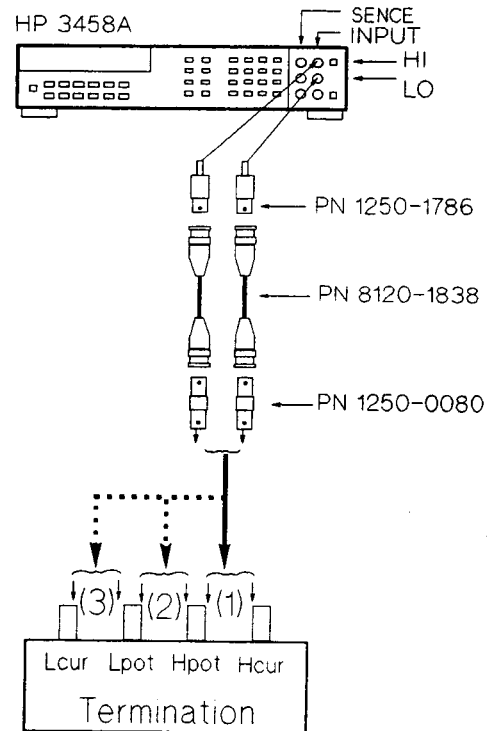


Figure 3-1. Verification Check Setup for OPEN and SHORT

**PROCEDURES for
SHORT**

1. Set the multimeter to the 2-Wire Resistance measurement mode.
2. Connect the multimeter to Hcur and Hpot of the SHORT termination as shown in Figure 3-1 (1).
3. Check that the multimeter's reading is less than 1Ω .
4. Connect the multimeter to Hpot and Lpot of the SHORT termination as shown in Figure 3-1 (2).
5. Check that the multimeter's reading is less than 1Ω .
6. Connect the multimeter to Lpot and Lcur of the SHORT termination as shown in Figure 3-1 (3).
7. Check that the multimeter's reading is less than 1Ω .

RESISTOR VERIFICATION CHECK

This verification check confirms that the resistance at DC of each HP 42100A's resistor is within the limits listed in Table 3-3.

Table 3-3. Verification Check Limit of Resistors

RESISTOR	CHECK LIMIT
10 Ω (HP 42101A)	9.9 Ω - 10.1 Ω
100 Ω (HP 42102A)	99 Ω - 101 Ω
1k Ω (HP 42103A)	0.99k Ω - 1.01k Ω
10k Ω (HP 42104A)	9.9k Ω - 10.1k Ω
100k Ω (HP 42105A)	99k Ω - 101k Ω

REQUIRED EQUIPMENT

Multimeter	HP 3458A (recommended)
Cable	BNC(m) to BNC (m) Cable (4EA)
Adapter	BNC(m) to Banana Plug Adapter (4EA)
	BNC(m) to BNC(m) Adapter (4EA)

PROCEDURES

1. Set the multimeter to the 4-Wire Resistance measurement mode.
2. Connect the multimeter to 10 Ω resistor as shown in Figure 3-2.
3. Check that the multimeter's reading is within the check limits of the 10 Ω resistor. Refer to Table 3-3.
4. Repeat steps 2 and 3 for the 100 Ω , 1k Ω , 10k Ω , and 100k Ω resistors.

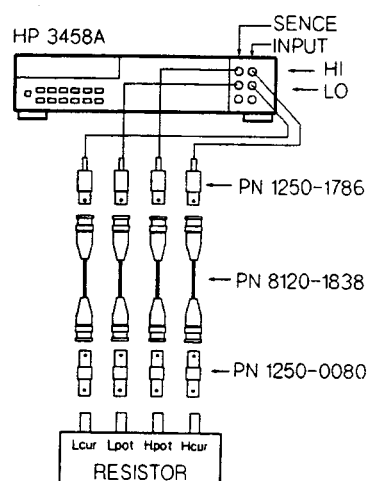


Figure 3-2. Verification Check Setup for Resistors

MANUAL CHANGES

INTRODUCTION

This section contains information for adapting this manual to instruments for which its contents do not directly apply. The following paragraphs explain how to adapt this manual to older instruments which have a serial prefix/number lower than that given on the title page.

MANUAL CHANGES

To adapt this manual to your instrument, refer to Table 4-1 and make all of the manual changes listed opposite your instrument's serial number. Perform these changes in the sequence given.

If your instrument serial number is not listed on the title page of this manual or in Table 4-1, or may be documented in a yellow MANUAL CHANGES supplement. For additional information about serial number coverage, refer to UNIT COVERED BY THIS MANUAL in Chapter 1.

Table 4-1. Manual Changes by Serial Number

Serial Prefix or Number	Make Manual Changes

SERVICE

INTRODUCTION

This section provides the service information for the HP 42100A Four-Terminal Pair Resister Set.

REPLACEABLE PARTS

Each of the HP 42100A's terminations or resistors can be replaced at the assembly level, if it is damaged. The replaceable part numbers are listed in Table 5-1.

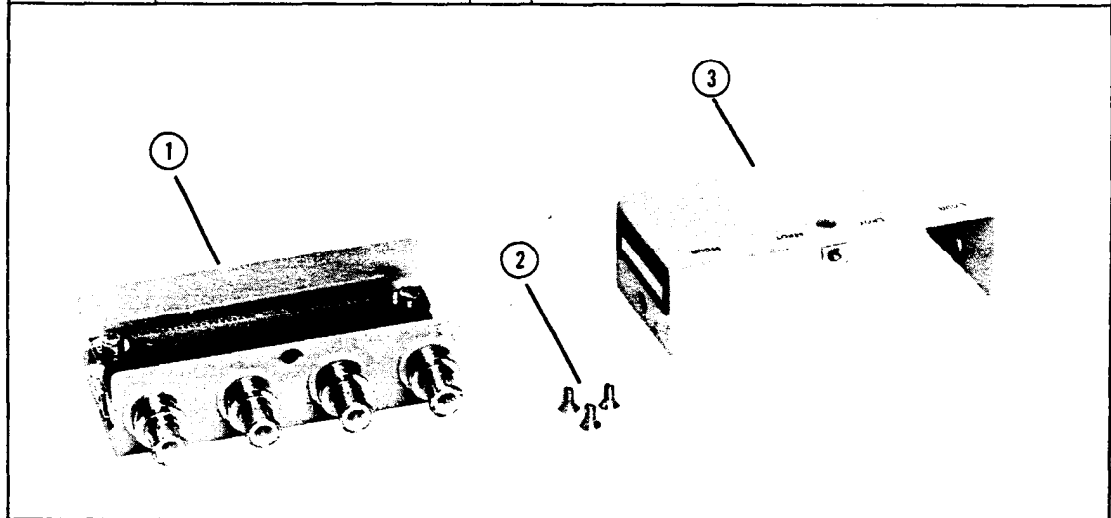
The top cover (PN 42090-04001) is common for all HP 42100A's terminations and resistors. When the top cover is replaced, the serial number plate on the damaged top cover should be moved to the new top cover.

VERIFICATION CHECK after REPAIR

After repair, perform the complete verification checks in accordance with *VERIFICATION CHECK* in chapter 3 of this manual. The HP 42100A doesn't have calibration values. Therefore the calibration of the HP 42100A is not required.

Table 5-1. Replaceable Parts List

Reference Designator	Part Number	Qty	Description
1	PN 42090-60001	1	OPEN Assembly (for HP 42090A)
	PN 42091-60001	1	SHORT Assembly (for HP 42091A)
	PN 42101-60001	1	10 Ω Assembly (for HP 42101A)
	PN 42102-60001	1	100 Ω Assembly (for HP 42102A)
	PN 42103-60001	1	1 k Ω Assembly (for HP 42103A)
	PN 42104-60001	1	10 k Ω Assembly (for HP 42104A)
	PN 42105-60001	1	100 k Ω Assembly (for HP 42105A)
2	PN 0515-0914	3	Screw
3	PN 42090-04001	1	Cover Top



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