HIOKI

CONFIDENTIAL

Calibration

IM3570

IMPEDANCE ANALYZER

Document No.: IM3570 W003
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Edition 1

HIOKI E. E. CORPORATION

Contents

1 Introduction

(1) This manual provides service information for IM3570.

(2) For more information on the operational procedures, operations and specifications, see the instruction manual.

(3) These products are susceptible to static electricity. Ground all electrical facilities and workbench before servicing.
To avoid shock hazards due to earth leakage from the electrical facilities, operators must always be grounded with a resistor of approximately 1 MΩ.

(4) When you apply a voltage to analyze the instrument, take care not to get any electrical shock.

(5) Check the condition of the solder bonding portions before starting the repair work.

(6) Precautions during adjustment
Do not turn off the power of the instrument during adjustments.
Power off during adjustment may damage the instrument.
Replace the batteries with new ones for instruments running on batteries before making adjustments to avoid power supply cut-off during the adjustments.
Follow the procedures for connecting and disconnecting USB cables and other cables.
Connecting or disconnecting any cable during adjustments may cause damage to the instrument.

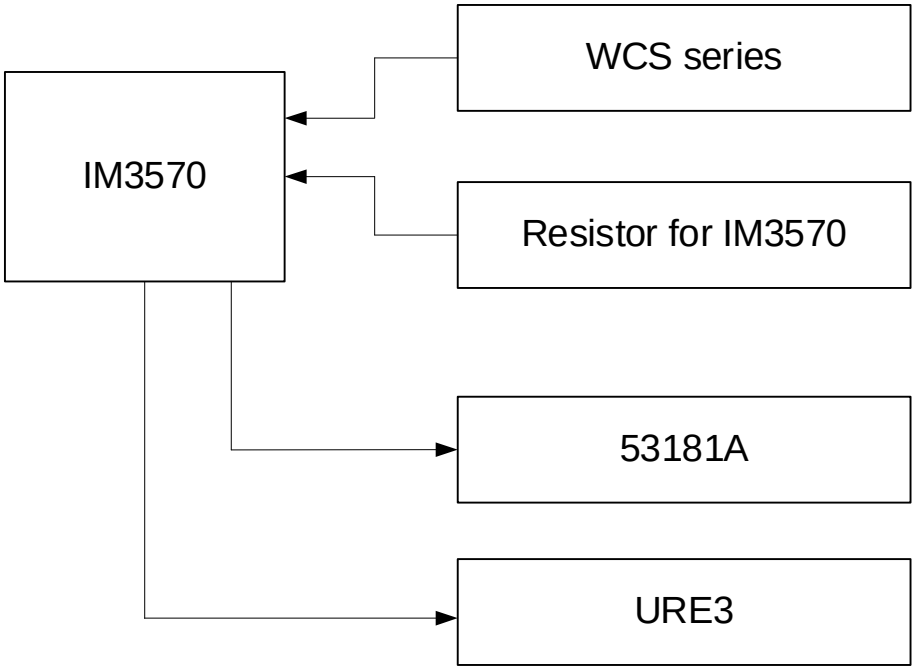
2 Calibration

2.1 Equipment Required

Device Name	Maker and Model Name
Frequency counter	Agilent Technologies 53181A or equivalent
Standard capacitor	1 pF, 10 pF, 100 pF, 10 nF,1 μF
Standard resistor	50 mΩ, 500 mΩ, 5 Ω, 50 kΩ
RMS voltmeter	ROHDE & SCHWARZ URE3 or equivalent
*OPEN tool for IM3570	HIOKI For OPEN circuit compensation to cancel a stray capacity between HIGH and LOW terminal
*SHORT tool for IM3570	HIOKI For SHORT circuit compensation to cancel a residual impedance between HIGH and LOW terminal
*Check tool	HIOKI To check that the contact check circuit operates normally.
PC	Optional

* (Contact your sales representative when it is necessary.)

2.2 Connection of the Devices



2.3 Requirements

Calibration requires the following ambient conditions:

- Temperature : 23°C ± 5°C
- Humidity : 80%RH or less
- Power supply voltage : 100 V± 10%
- Power on the equipment at least 60 minutes before starting calibration.

2.4 Calibration Procedure

No	Item	Calibration procedure (Method)	Judgment standard
1	Execution of test program	(1) Display (LCD, LED) check program Command ":FACTory:TEST:DISPlay" MEAS LED ⋯ Green IN LED ⋯ Green OUT LED ⋯ Red Power LED ⋯ Green (When the Power is turned ON.) Red (When the Power is turned OFF : Confirm it before turning on the Power.) (2) Key check program Command ":FACTory:TEST:SCReen" Note 1. Use a touch pen. 2. When the key is input, confirm buzzer sound also.	(1) • There should not be a flashing pixel by all the colors. • LEDs should be lighted. (2) • ○ mark should be indicated to each key. • The buzzer should sound. (When the key is input.)
1	Execution of test program	(3) EXT I/O check program Command ":FACTory:TEST:IO?" (4) RAM check program Command "*TST?" (5) USB memory check Command ":FACTory:TEST:USBMemory?"	(3) Should be "0". (4) Should be "0". (5) Should be "0".
2	Backup battery check	Set up the present time. Turn the Power of the instrument off. Turn the Power on again 15 seconds later and confirm that the time is held. :SYSTem:DATE <year>,<month>,<date> :SYSTem:DATE? :SYSTem:TIME <hour>,<minute>,<second > :SYSTem:TIME?	Should be ± 60 seconds of time of PC.
3	GP-IB	Operate inspection software with GP-IB. And confirm that the inspection software operates normally. At the time of GP-IB setting ":FACTory:INTErface GPIB"	The inspection software should operate normally.
4	RS-232C	Set to hard flow before opening port. Execute the command ":HANDshake HARD", "*IDN?" via RS-232C. And confirm that the correct response is obtained. At the time of RS-232C setting, ":FACTory:INTErface RS"	Response data should include "HIOKI,IM3570,0,V01.00".

<table>
<tr><th>No</th><th>Item</th><th>Calibration procedure (Method)</th><th>Judgment standard</th></tr>
<tr><td>5</td><td>LAN</td><td>Execute "*IDN?" via LAN.
And confirm that the correct response is obtained.
At the time of LAN setting,
":FACTory:INTErface LAN"
IP address 192. 168. 0.1
Subnet 255. 255. 255.0
Port No. 3570
Protocol TCP</td><td>Response data should be "HIOKI,IM3570,0,V01.00".</td></tr>
<tr><td>6</td><td>USB</td><td>Execute "*IDN?" via USB.
And confirm that the correct response is obtained.
At the time of USB setting,
":FACTory:INTErface USB"</td><td>Response data should be "HIOKI,IM3570,0,V01.00".</td></tr>
<tr><td>7</td><td>Measurement frequency</td><td>Check the values of the following frequency levels with the HCUR terminal.
Frequency : 1 kHz, 5 MHz (1 Vrms)</td><td>The value should be within ±0.008% of setting value.</td></tr>
<tr><td>8</td><td>Measurement signal level</td><td colspan="2">Set the following measurement conditions.
Leave the measurement terminals open, measure voltage of the H-L terminals and check the variance from the setting value.
Note. Hold next item at the time of DC measurement.
DC ADJ : OFF, Range : 100 MΩ
<table>
<tr><th>Frequency</th><th>Voltage</th><th>Accuracy</th></tr>
<tr><td>DC</td><td>1 V</td><td>±88 mV</td></tr>
<tr><td rowspan="3">1 kHz</td><td>100 mV</td><td>±16 mV</td></tr>
<tr><td>1 V</td><td>±88 mV</td></tr>
<tr><td>5 V</td><td>±408 mV</td></tr>
<tr><td rowspan="3">1 MHz</td><td>100 mV</td><td>±16 mV</td></tr>
<tr><td>1 V</td><td>±88 mV</td></tr>
<tr><td>5 V</td><td>±408 mV</td></tr>
</table>
Note. At the time of the DC measurement, use the following special command.
":FACTory:RDCmode", ":DCResistance:LEVel:VOLTage 1"</td></tr>
<tr><td>9</td><td>Measurement signal level (Monitor)</td><td colspan="2">Set the following measurement conditions.
Leave the measurement terminals open, measure voltage of the H-L terminals and check the variance from the value displayed by the measurement signal level monitor. (AUTO range)
<table>
<tr><th>Frequency</th><th>Voltage</th><th>Accuracy</th></tr>
<tr><td>DC</td><td>1 V</td><td>±88 mV</td></tr>
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</table></td></tr>
</table>

<table>
<tr><th>No</th><th>Item</th><th>Calibration procedure (Method)</th><th>Judgment standard</th></tr>
<tr><td>10</td><td>SYNC-SOURCE</td><td>Make the external TRIG non-measurement condition. Turn on SYNC-SOURCE. Make the measurement terminal open condition.
Measure voltage of the H-L terminals and confirm that voltage is almost 0 V.
1 MHz : 1 V</td><td>Should be within the following range toward setting value.

1 MHz, 1 V : 10 mV or less</td></tr>
<tr><td>11</td><td>Contact check</td><td>Set up it to low Z high accuracy mode, 1 Ω range.
Confirm that each contact check of both L side and H side is normal (Error display) by the check tool.</td><td>Following error display should appear.
L side : L NO CNTCT
H side : H NO CNTCT</td></tr>
<tr><td rowspan="2">12</td><td>Confirmation of calibration date of standard value</td><td>Confirm the calibration date of standard value.
When the software version No. is 1.02,
Completely ⋯ June 8, 2010.
When the software version No. is after 2.00,
• Quantity product goods, repair/calibration goods (at the time of the re-adjustment)⋯The latest calibration date
• Repair/calibration goods (Re-adjustment is not carried out.)⋯Date after June 8, 2010
* Serial No. of the quantity product goods is "-1-000001".
Standard value acquisition command is as follows.
":FACT:STAN:DATE?"</td><td>Calibration date should correspond.</td></tr>
<tr><td>Confirmation of the adjustment date (When the software version No. is after 2.00)</td><td>Confirm the adjustment date.
Condition (1) :
Calibration date of the standard value is June 8, 2010 and the adjustment date is June 10, 1935 and the repair/calibration goods. (Re-adjustment is not carried out.)
Condition (2) :
Calibration date of the standard value is less than or equal to adjustment date.
Adjustment date is less than or equal to inspection date.
Adjustment value acquisition command is as follows.
":FACT:CAL:DATE?"</td><td>The adjustment date should satisfy the condition (1) or condition (2).</td></tr>
<tr><td>13</td><td>Accuracy (Cable 0 m)</td><td colspan="2">At the manual range and the following settings, measure the following points.
Measurement speed : SLOW 2
Measurement parameter : Z-θ
Cable length : 0 m
(After the equipment has been on for at least 60 minutes, carry out OPEN/SHORT circuit compensation.)

<table>
<tr><th rowspan="2">Test sample</th><th rowspan="2">Range</th><th rowspan="2">Frequency</th><th rowspan="2">Voltage</th><th colspan="2">Accuracy</th></tr>
<tr><th>Z (Rdc) (%)</th><th>θ (°)</th></tr>
<tr><td rowspan="3">50 mΩ</td><td rowspan="3">100 mΩ</td><td>DC</td><td>1 V</td><td>±4%</td><td>-</td></tr>
<tr><td>1 kHz</td><td>1 V</td><td>±4%</td><td>2.8°</td></tr>
<tr><td>100 kHz</td><td>1 V</td><td>±3.2%</td><td>2.8°</td></tr>
</table></td><td>Should be within accuracy.</td></tr>
</table>

No	Item	Calibration procedure (Method)				Judgment standard	
13	Accuracy (Cable 0 m)	Test sample	Range	Frequency	Voltage	Accuracy	
						Z (Rdc) (%)	θ (°)
		50 mΩ	100 mΩ (Low Z mode)	DC	1 V	±4%	-
				1 kHz	1 V	±4%	2.8°
				100 kHz	1 V	±3.2%	2.8°
		500 mΩ	1 Ω	DC	1 V	±0.48%	-
				100 Hz	40 mV	±1.575%	±1.225°
					100 mV	±0.90%	±0.70°
					500 mV	±0.54%	±0.42°
					1 V	±0.45%	±0.35°
					5 V	±0.45%	±0.35°
				10 kHz	1 V	±0.35%	±0.225°
				1 MHz	1 V	±1.6%	±0.96°
			1 Ω (Low Z mode)	DC	1 V	±0.48%	-
				100 Hz	1 V	±0.45%	±0.35°
				10 kHz	40 mV	±1.96%	±1.26°
					100 mV	±1.12%	±0.72°
					500 mV	±0.42%	±0.27°
					1 V	±0.35%	±0.225°
				100 kHz	1 V	±0.35%	±0.225°
		5 Ω	10 Ω	20 Hz	1 V	±0.35%	±0.20°
				1 kHz	1 V	±0.175%	±0.09°
				1 MHz	1 V	±0.388%	±0.307°
		50 kΩ	100 kΩ	DC	1 V	±0.09%	-
				100 Hz	1 V	±0.105%	±0.074°
				100 kHz	1 V	±0.205%	±0.13°
		1 pF	100 MΩ	10 kHz	1 V	±2.788%	±2.546°
			10 MΩ	100 kHz	1 V	±0.942%	±0.688°
			1 MΩ	1 MHz	1 V	±1.037%	±1.037°
			100 kΩ	5 MHz	1 V	±4.123%	±3.61°
		10 pF	100 MΩ	1 kHz	1 V	±3.346%	±2.546°
			30 kΩ	1 MHz	1 V	±0.492%	±0.343°
			10 kΩ	5 MHz	1 V	±2.583%	±1.923°
		100 pF	100 MΩ	100 Hz	1 V	2.788%	±2.123°
			10 MΩ	1 kHz	40 mV	±4.606%	±3.525°
					100 mV	±2.168%	±1.658°
					500 mV	±0.867%	±0.663°
					1 V	±0.542%	±0.414°
					5 V	±0.542%	±0.414°
			1 MΩ	10 kHz	1 V	±0.165%	±0.106°
			3 kΩ	1 MHz	40 mV	±0.961%	±0.541°
					100 mV	±0.549%	±0.309°
					500 mV	±0.330%	±0.186°
					1 V	±0.274%	±0.154°
					5 V	±0.274%	±0.154°
			1 kΩ	5 MHz	1 V	±2.029%	±1.363°

No	Item	Calibration procedure (Method)				Judgment standard	
13	Accuracy (Cable 0 m)	Test sample	Range	Frequency	Voltage	Accuracy	
						Z (Rdc) (%)	θ (°)
		10 nF	1 MΩ	100 Hz	1 V	±0.165%	±0.106°
			30 kΩ	1 kHz	1 V	±0.113%	±0.074°
			3 kΩ	10 kHz	1 V	±0.114%	±0.071°
			1 kΩ	20 kHz	1 V	±0.200%	±0.120°
			300 Ω	1 MHz	1 V	±0.668%	±0.405°
			10 Ω	5 MHz	1 V	±8.340%	±6.626°
		1 µF	10 kΩ	40 Hz	1 V	±0.264%	±0.264°
			3 kΩ	100 Hz	1 V	±0.178%	±0.086°
			1 kΩ	200 Hz	1 V	±0.216%	±0.108°
			300 Ω	1 kHz	1 V	±0.049%	±0.030°
			10 Ω	100 kHz	1 V	±0.282%	±0.154°
		1 µF (DC bias 2.5 V)	10 kΩ	40 Hz	1 V	±0.581%	±0.581°
			3 kΩ	100 Hz	1 V	±0.390%	±0.191°
			1 kΩ	200 Hz	1 V	±0.474%	±0.238°
			300 Ω	1 kHz	1 V	±0.172%	±0.103°
			10 Ω	100 kHz	1 V	±0.993%	±0.543°
14	Accuracy (Cable length) Note. Cable connection Red : Hc White : Hp Green : Lp Blue : Lc	At the manual range and the following settings, measure the following points. Measurement speed : SLOW2 Measurement parameter : Z-θ Cable length : 1 m, 2 m and 4 m Note. Set the cable length of the instrument to the cable length that is examined. Then carry out OPEN/SHORT circuit compensation. Cable length 1 m=DC to 5 MHz Cable length 2 m=DC to 1 MHz Cable length 4 m=DC to 100 kHz				Should be within accuracy.	

Test sample	Range	Frequency	Voltage	Accuracy		Accuracy		Accuracy	
				Z (%)	θ (°)	Z (%)	θ (°)	Z (%)	θ (°)
				1m	1m	2m	2m	4m	4m
50 mΩ	100 mΩ	DC	1 V	±6.000%	-	±8.000%	-	±16.000 %	-
		1 kHz	1 V	±6.000%	4.200°	±8.080%	5.656°	±16.16%	11.312°
		100 kHz	1 V	±4.800%	4.200°	±12.80%	11.20°	-----	-----
	100 mΩ (Low Z mode)	DC	1 V	±6.000%	-	±8.000%	-	±16.000 %	-
		1 kHz	1 V	±6.000%	4.200°	±8.080%	5.656°	±16.16%	11.312°
		100 kHz	1 V	±4.800%	4.200°	±12.80%	11.20°	-----	-----
1 pF	100 MΩ	10 kHz	1 V	±4.880%	±3.820°	±7.362%	±5.602°	±14.724 %	±11.204°
	10 MΩ	100 kHz	1 V	±1.649%	±1.247°	±4.525%	±3.578°	-----	-----
	1 MΩ	1 MHz	40 mV	±13.217 %	±13.217°	-----	-----	-----	-----
			100 mV	±6.220%	±6.220°	-----	-----	-----	-----
			500 mV	±2.448%	±2.448°	-----	-----	-----	-----
			1 V	±1.555%	±1.555°	-----	-----	-----	-----
			5 V	±1.555%	±1.555°	-----	-----	-----	-----
	100 kΩ	5 MHz	1 V	±7.213%	±6.372°	-----	-----	-----	-----

<table>
<tr><th>No</th><th colspan="2">Item</th><th colspan="2">Calibration procedure (Method)</th><th colspan="4">Judgment standard</th></tr>
<tr><td rowspan="10">14</td><td rowspan="2">Test sample</td><td rowspan="2">Range</td><td rowspan="2">Frequency</td><td rowspan="2">Voltage</td><td colspan="2">Accuracy</td><td colspan="2">Accuracy</td><td colspan="2">Accuracy</td></tr>
<tr><td>Z (%)</td><td>θ (°)</td><td>Z (%)</td><td>θ (°)</td><td>Z (%)</td><td>θ (°)</td></tr>
<tr><td></td><td></td><td></td><td></td><td colspan="2">1m</td><td colspan="2">2m</td><td colspan="2">4m</td></tr>
<tr><td rowspan="7">10 nF</td><td>1 MΩ</td><td>100 Hz</td><td>1 V</td><td>±0.396%</td><td>±0.254°</td><td>±0.529%</td><td>±0.340°</td><td>±1.057%</td><td>±0.679°</td></tr>
<tr><td>30 kΩ</td><td>1 kHz</td><td>1 V</td><td>±0.170%</td><td>±0.112°</td><td>±0.229%</td><td>±0.150°</td><td>±0.459%</td><td>±0.301°</td></tr>
<tr><td>10 kΩ</td><td>2 kHz</td><td>1 V</td><td>±0.186%</td><td>±0.113°</td><td>±0.253%</td><td>±0.153°</td><td>±0.506%</td><td>±0.307°</td></tr>
<tr><td>3 kΩ</td><td>10 kHz</td><td>1 V</td><td>±0.170%</td><td>±0.107°</td><td>±0.250%</td><td>±0.157°</td><td>±0.500%</td><td>±0.313°</td></tr>
<tr><td>1 kΩ</td><td>20 kHz</td><td>1 V</td><td>±0.324%</td><td>±0.180°</td><td>±0.518%</td><td>±0.288°</td><td>-----</td><td>-----</td></tr>
<tr><td>300 Ω</td><td>1 MHz</td><td>1 V</td><td>±1.002%</td><td>±0.608°</td><td>-----</td><td>-----</td><td>-----</td><td>-----</td></tr>
<tr><td>10 Ω</td><td>5 MHz</td><td>1 V</td><td>±12.51%</td><td>±9.940°</td><td>-----</td><td>-----</td><td>-----</td><td>-----</td></tr>
<tr><td>15</td><td colspan="2">Sweep measurement</td><td colspan="2">At the AUTO range and the following settings, measure the following points.
Measurement object : 100 pF
Measurement frequency :
Segment 1 : 20 to 100 Hz (9 points, LINEAR)
Segment 2 : 150 to 1 kHz (18 points, LINEAR)
Segment 3 : 1.5 k to 10 kHz (18 points, LINEAR)
Segment 4 : 15 k to 100 kHz (18 points, LINEAR)
Segment 5 : 150 k to 1 MHz (18 points, LINEAR)
Segment 6 : 1.25 MHz to 5 MHz (16 points, LINEAR)
Measurement level : 1 V
Measurement parameter : Cp
Measurement speed : FAST
Draw : AFTER
Point delay : 0 s
Cable length : 1 m
Comparator : Area judgment
Reference value : Use calibration value in 1 kHz.
Upper lower limit value : Segment 1 : ± 3%
Segment 2 to 5 : ± 0.5%
Segment 6 : ± 5%
Note. Set the cable length of the instrument to the cable length that is examined. Then carry out OPEN/SHORT circuit compensation.</td><td colspan="4">With the area judgment (COMP function) of the instrument, the judgment result should be IN.</td></tr>
<tr><td>16</td><td colspan="2">MAC address check</td><td colspan="2">Check MAC address.
:SYSTem:MACAddress?</td><td colspan="4">The MAC address should be set normally.
(Example)
12-34-56-78-90-AB</td></tr>
<tr><td>17</td><td colspan="2">Serial No. check</td><td colspan="2">Check Serial No.
:SYSTem:SERIAlno?</td><td colspan="4">The Serial No. should be set normally.
(Example)
100610000</td></tr>
</table>