



# 校准报告

## CALIBRATION REPORT



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客户名称 : 长沙开元仪器股份有限公司  
Name of Customer

客户地址 : 长沙经济技术开发区开元路172号  
Address of Customer

计量器具名称: 接触电流测试仪  
Name of Instrument

器具用途 : \_\_\_\_\_  
Use of Instrument

型号/规格 : TG76010  
Type/Specification

出厂编号 : 0701SLHY280007  
Serial No

资产编号 : \_\_\_\_\_  
Asset No

制造单位 : 天格(台湾)测控股份有限公司  
Manufacturer

校准依据 : 见注3  
Calibrated in Accordance to

(校准专用章)  
Stamp



校准日期 : 2014 年 08 月 21 日  
Operation Date Year Month Day

建议复校日期: 2015 年 08 月 20 日  
Suggested Recal.Date Year Month Day

批准人 : 王敬喜(技术主管)  
Authorized by

签名 : 王敬喜  
Signature

核验员 : 王敬喜  
Checked by

校准员 : 古建平  
Calibrated by



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## 校准用主要计量标准装置信息 Main Standard Devices Used

| 名称<br>Equipment Name | 测量范围<br>Measuring Range | 不确定度/准确度等级/<br>最大允许误差<br>Uncertainty/Accuracy Class/<br>Maximum Permissible Error | 计量标准考核证书号<br>Certificate No | 有效期至<br>Due Date |
|----------------------|-------------------------|---|-----------------------------|------------------|
| -----                | -----                   | -----   | -----                       | -----            |
|                      |                         |   |                             |                  |
|                      |                         |   |                             |                  |

## 校准用主要标准器信息 Main Standards of Measurement Used

| 名称<br>Equipment Name | 测量范围<br>Measuring Range  | 不确定度/准确度等级/<br>最大允许误差<br>Uncertainty/Accuracy Class/<br>Maximum Permissible Error    | 设备编号<br>Equipment No | 证书号<br>Certificate No | 有效期至<br>Due Date |
|----------------------|--|--|----------------------|-----------------------|------------------|
| 多用表校准源               | ACU: (1nV~1100V);<br>DCU: (10nV~1100V);<br>ACI: (1nA~2.2A);<br>DCI: (0.1nA~2.2A);<br>R: (0Ω~100MΩ) | ACU: ±0.0075%R; DCU:<br>±0.0007%R; ACI: ±0.014%R;<br>DCI: ±0.005%R; R: ±0.0012%<br>R | SB0575               | 检定字第<br>201309106711号 | 2014-09-08       |
| 数字万用表                | ACU: (10nV~700V);<br>DCU: (10nV~1050V);<br>ACI: (0.1nA~1A);<br>DCI: (1pA~1A); R:<br>(10μΩ~1GΩ)     | ACU: ±0.007%R; DCU:<br>±0.0004%R; ACI: ±0.03%R;<br>DCI: ±0.002%R; R: ±0.001%R        | SB8658               | DLsc2014-0106         | 2015-01-28       |
| 高频LCR表               | 频率: 20Hz~2MHz,<br>电阻: 1Ω~100kΩ,<br>电容: 1pF~1F, 电<br>感: 1μH~1000H                                   | MPE: ±0.05%  | SB9942               | XDWB2014-0085         | 2015-02-17       |
|                      |  |  |                      |                       |                  |
|                      |  |  |                      |                       |                  |

## 附加说明 Appended Directions

委托日期:  
Application Date  
检定地点:  
Operation Location

2014 年 08 月 21 日  
本院222室



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## 校准结果

Results of Calibration

环境条件:

Operation Environment

温度 23 °C 相对湿度 60 %

符合性及限制使用说明:

Statement of Compliance and Limitation

参见校准结果



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## 校准结果

Results of Calibration

- 外观及功能性检查: 正常。  
Appearance check: Normal
- 测量网络直流输入电阻误差: 见表 1  
Error of DC input resistance for measurement network: see Table 1

表 1 ( Table 1 ) 测量网络直流输入电阻误差

| 测量网络<br>Network | 参考值<br>Reference Value | 测得值<br>Meas. Value | 误差<br>Error | 最大允许误差<br>MPE | 结论<br>Conclusion |
|-----------------|------------------------|--------------------|-------------|---------------|------------------|
|                 | ( $\Omega$ )           | ( $\Omega$ )       | ( % )       | ( % )         | ( Pass or Fail ) |
| 网络 3            | 2000                   | 1999.3             | 0.0         | $\pm 1$       | P                |
| 网络 5            | 2000                   | 1998.4             | -0.1        | $\pm 1$       | P                |
| 网络 6            | 875                    | 873.6              | -0.2        | $\pm 1$       | P                |

- 交流电流测量示值误差(  $f = 50 \text{ Hz}$  ): 见表 2、表 3、表 4  
Indication error of AC current(  $f = 50 \text{ Hz}$  ) : see Table 2、Table 3、Table 4

表 2 ( Table 2 ) 网络 3 交流电流测量示值误差(  $f = 50 \text{ Hz}$  )

| 标准示值<br>Std. Indication | 示值<br>Indication | 误差<br>Error | 最大允许误差<br>MPE | 结论<br>Conclusion |
|-------------------------|------------------|-------------|---------------|------------------|
| ( mA )                  | ( mA )           | ( % )       | ( % )         | ( Pass or Fail ) |
| 0.1000                  | 0.09988          | -0.1        | $\pm 5$       | P                |
| 0.2000                  | 0.19965          | -0.2        | $\pm 5$       | P                |
| 0.5000                  | 0.499            | -0.2        | $\pm 5$       | P                |
| 1.0000                  | 0.997            | -0.3        | $\pm 5$       | P                |
| 2.0000                  | 1.994            | -0.3        | $\pm 5$       | P                |
| 5.000                   | 4.99             | -0.2        | $\pm 5$       | P                |
| 9.000                   | 8.97             | -0.3        | $\pm 5$       | P                |



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### 校准结果 Results of Calibration

表 3 ( Table 3 ) 网络 5 交流电流测量示值误差 (  $f = 50 \text{ Hz}$  )

| 标准示值<br>Std. Indication | 示值<br>Indication | 误差<br>Error | 最大允许误差<br>MPE | 结论<br>Conclusion |
|-------------------------|------------------|-------------|---------------|------------------|
| ( mA )                  | ( mA )           | ( % )       | ( % )         | ( Pass or Fail ) |
| 10.000                  | 9.95             | -0.5        | $\pm 5$       | P                |
| 20.000                  | 19.85            | -0.7        | $\pm 2$       | P                |
| 40.00                   | 39.76            | -0.6        | $\pm 2$       | P                |
| 60.00                   | 59.68            | -0.5        | $\pm 2$       | P                |
| 80.00                   | 79.56            | -0.5        | $\pm 2$       | P                |
| 90.00                   | 89.52            | -0.5        | $\pm 2$       | P                |

表 4 ( Table 4 ) 网络 6 交流电流测量示值误差 (  $f = 50 \text{ Hz}$  )

| 标准示值<br>Std. Indication | 示值<br>Indication | 误差<br>Error | 最大允许误差<br>MPE | 结论<br>Conclusion |
|-------------------------|------------------|-------------|---------------|------------------|
| ( mA )                  | ( mA )           | ( % )       | ( % )         | ( Pass or Fail ) |
| 0.1000                  | 0.10             | 0.0         | $\pm 5$       | P                |
| 0.2000                  | 0.20             | 0.0         | $\pm 5$       | P                |
| 0.5000                  | 0.50             | 0.0         | $\pm 5$       | P                |
| 1.0000                  | 1.00             | 0.0         | $\pm 5$       | P                |
| 2.0000                  | 1.99             | -0.5        | $\pm 5$       | P                |
| 5.000                   | 4.98             | -0.4        | $\pm 5$       | P                |
| 9.000                   | 8.93             | -0.8        | $\pm 5$       | P                |



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## 校准结果

Results of Calibration

- 4 感知/反应接触电流测量网络的输入阻抗(网络 3): 见表 5  
Input impedance for perception or reaction touch current measuring network  
( Network 3 ): see Table 5

表 5 ( Table 5 ) 感知/反应接触电流测量网络的输入阻抗(网络 3)

| 频率<br>Freq | 参考值<br>Ref. Value | 测得值<br>Meas. Value | 误差<br>Error | 最大允许误差<br>MPE | 结论<br>Conclusion |
|------------|-------------------|--------------------|-------------|---------------|------------------|
|            | ( Ω )             | ( Ω )              | ( % )       | ( % )         | ( Pass or Fail ) |
| 20 Hz      | 1998              | 1997.1             | 0.0         | ±5            | P                |
| 50 Hz      | 1990              | 1988.7             | -0.1        | ±5            | P                |
| 60 Hz      | 1986              | 1984.2             | -0.1        | ±5            | P                |
| 100 Hz     | 1961              | 1959.5             | -0.1        | ±5            | P                |
| 200 Hz     | 1857              | 1855.3             | -0.1        | ±5            | P                |
| 500 Hz     | 1433              | 1430.7             | -0.2        | ±5            | P                |
| 1 kHz      | 973               | 970.6              | -0.2        | ±5            | P                |
| 2 kHz      | 661               | 660.0              | -0.2        | ±5            | P                |
| 5 kHz      | 512               | 511.7              | -0.1        | ±5            | P                |
| 10 kHz     | 485               | 485.4              | 0.1         | ±5            | P                |
| 20 kHz     | 479               | 478.4              | -0.1        | ±5            | P                |
| 50 kHz     | 477               | 476.3              | -0.1        | ±5            | P                |
| 100 kHz    | 476               | 475.3              | -0.1        | ±10           | P                |
| 200 kHz    | 476               | 472.3              | -0.8        | ±10           | P                |
| 500 kHz    | 476               | 469.3              | -1.4        | ±10           | P                |
| 1 MHz      | 476               | 451.4              | -5.2        | ±10           | P                |

- 5 未加权接触电流测量网络的输入阻抗(网络 5): 见表 6  
Input impedance for unweighted touch current measuring network( Network 5 ):  
see Table 6



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### 校准结果

Results of Calibration

表 6 ( Table 6 ) 未加权接触电流测量网络的输入阻抗( 网络 5 )

| 频率<br>Freq | 参考值<br>Ref. Value | 测得值<br>Meas. Value | 误差<br>Error | 最大允许误差<br>MPE | 结论<br>Conclusion |
|------------|-------------------|--------------------|-------------|---------------|------------------|
|            | ( $\Omega$ )      | ( $\Omega$ )       | ( % )       | ( % )         | ( Pass or Fail ) |
| 20 Hz      | 1998              | 1996.3             | -0.1        | $\pm 5$       | P                |
| 50 Hz      | 1990              | 1988.0             | -0.1        | $\pm 5$       | P                |
| 60 Hz      | 1986              | 1983.4             | -0.1        | $\pm 5$       | P                |
| 100 Hz     | 1961              | 1958.2             | -0.1        | $\pm 5$       | P                |
| 200 Hz     | 1857              | 1854.4             | -0.1        | $\pm 5$       | P                |
| 500 Hz     | 1434              | 1430.9             | -0.2        | $\pm 5$       | P                |
| 1 kHz      | 979               | 975.8              | -0.3        | $\pm 5$       | P                |
| 2 kHz      | 675               | 673.5              | -0.2        | $\pm 5$       | P                |
| 5 kHz      | 533               | 532.2              | -0.2        | $\pm 5$       | P                |
| 10 kHz     | 509               | 507.5              | -0.3        | $\pm 5$       | P                |
| 20 kHz     | 502               | 501.0              | -0.2        | $\pm 5$       | P                |
| 50 kHz     | 500               | 498.9              | -0.2        | $\pm 5$       | P                |
| 100 kHz    | 500               | 497.9              | -0.4        | $\pm 10$      | P                |
| 200 kHz    | 500               | 494.7              | -1.1        | $\pm 10$      | P                |
| 500 kHz    | 500               | 489.8              | -2.0        | $\pm 10$      | P                |
| 1 MHz      | 500               | 466.9              | -6.6        | $\pm 10$      | P                |

6 接触电流测量网络的接触电流示值误差: 见表 7、表 8

Indication error of touch current for touch current measuring network:  
see Table 7、Table 8



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Results of Calibration

表 7 ( Table 7 ) 感知/反应接触电流测量网络( 网络 3 )的接触电流示值误差

| 频率<br>Freq | 参考值<br>Reference Value | 示值<br>Indication | 误差<br>Error | 最大允许误差<br>MPE | 结论<br>Conclusion |
|------------|------------------------|------------------|-------------|---------------|------------------|
|            | ( mA )                 | ( mA )           | ( % )       | ( % )         | ( Pass or Fail ) |
| 20 Hz      | 10.00                  | 10.00            | 0.0         | ±5            | P                |
| 50 Hz      | 9.98                   | 10.02            | -0.4        | ±5            | P                |
| 60 Hz      | 9.96                   | 9.95             | 0.1         | ±5            | P                |
| 100 Hz     | 9.90                   | 9.90             | 0.0         | ±5            | P                |
| 200 Hz     | 9.60                   | 9.59             | 0.1         | ±5            | P                |
| 500 Hz     | 8.10                   | 8.15             | -0.6        | ±5            | P                |
| 1 kHz      | 5.68                   | 5.73             | -0.9        | ±5            | P                |
| 2 kHz      | 3.258                  | 3.30             | -1.3        | ±5            | P                |
| 5 kHz      | 1.366                  | 1.384            | -1.3        | ±5            | P                |
| 10 kHz     | 0.688                  | 0.697            | -1.3        | ±5            | P                |
| 20 kHz     | 0.3442                 | 0.349            | -1.4        | ±5            | P                |
| 50 kHz     | 0.1378                 | 0.13940          | -1.1        | ±5            | P                |
| 100 kHz    | 0.0690                 | 0.06992          | -1.3        | ±5            | P                |
| 200 kHz    | 0.0344                 | 0.03500          | -1.7        | ±5            | P                |
| 500 kHz    | 0.0551                 | 0.05565          | -1.0        | ±5            | P                |
| 1 MHz      | 0.0276                 | 0.02752          | 0.3         | ±5            | P                |

表 8 ( Table 8 ) 未加权接触电流测量网络( 网络 5 )的接触电流示值误差

| 频率<br>Freq | 参考值<br>Reference Value | 示值<br>Indication | 误差<br>Error | 最大允许误差<br>MPE | 结论<br>Conclusion |
|------------|------------------------|------------------|-------------|---------------|------------------|
|            | ( mA )                 | ( mA )           | ( % )       | ( % )         | ( Pass or Fail ) |
| 20 Hz      | 10.00                  | 9.98             | 0.2         | ±5            | P                |
| 50 Hz      | 10.00                  | 9.96             | 0.4         | ±5            | P                |
| 60 Hz      | 10.00                  | 9.97             | 0.3         | ±5            | P                |
| 100 Hz     | 10.00                  | 9.96             | 0.4         | ±5            | P                |
| 200 Hz     | 10.00                  | 9.97             | 0.3         | ±5            | P                |





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|         |       |      |     |    |   |
|---------|-------|------|-----|----|---|
| 500 Hz  | 10.00 | 9.94 | 0.6 | ±5 | P |
| 1 kHz   | 10.00 | 9.97 | 0.3 | ±5 | P |
| 2 kHz   | 10.00 | 9.95 | 0.5 | ±5 | P |
| 5 kHz   | 10.00 | 9.95 | 0.5 | ±5 | P |
| 10 kHz  | 10.00 | 9.97 | 0.3 | ±5 | P |
| 20 kHz  | 10.00 | 9.95 | 0.5 | ±5 | P |
| 50 kHz  | 10.00 | 9.95 | 0.5 | ±5 | P |
| 100 kHz | 10.00 | 9.95 | 0.5 | ±5 | P |
| 200 kHz | 10.00 | 9.96 | 0.4 | ±5 | P |
| 500 kHz | 10.00 | 9.96 | 0.4 | ±5 | P |
| 1 MHz   | 10.00 | 9.92 | 0.8 | ±5 | P |

注: 1 本次测量不确定度说明:

Notes: Uncertainty in the Measurement

- 1.1 依据 JJF 1059.1-2012 测量不确定度评定与表示  
According to JJF 1059.1-2012 Evaluation and Expression of Uncertainty in Measurement.
- 1.2 电阻测量结果的相对扩展不确定度:  $U_{rel} = 0.16\%$ ,  $k = 2$   
Related Expanded Uncertainty of Resistance:  $U_{rel} = 0.16\%$ ,  $k = 2$
- 1.3 交流电流测量结果的相对扩展不确定度:  $U_{rel} = 0.16\%$ ,  $k = 2$   
Related Expanded Uncertainty of AC Current:  $U_{rel} = 0.16\%$ ,  $k = 2$
- 1.4 阻抗测量结果的相对扩展不确定度:  $U_{rel} = 0.5\%$ ,  $k = 2$   
Related Expanded Uncertainty of Impedance:  $U_{rel} = 0.5\%$ ,  $k = 2$
- 2 结论判断依据: 仪器说明书技术要求。  
Basis for the conclusion: Technical Specification of the Instrument.



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- 3 校准依据  
Calibrated in Accordance to
- 3.1 JJG 843-2007 泄漏电流测试仪  
JJG 843-2007 Leakage Current Tester
- 3.2 GB/T 12113-2003 接触电流和保护导体电流的测量方法  
GB/T 12113-2003 Methods of measurement of touch current and  
protective conductor current

