DANISENSE

DANAK
CAL Reg.no. 613
Member EA MLA

# Certificate of Calibration

This certificate provides measurement results that are traceable to the SI (The International System of Units) through internationally recognized standards.

| | |
|---|---|
| **Object** | DC Current Transducer and Control Unit |
| **Manufacturer** | Danisense |
| **Type** | DR10000IM |
| **Identification** | SampleID |
| **Serial number** | SampleSN |
| **Customer** | Sample Customer |
| **Customer address** | Sample customer address |
| | Sample customer address 2 |
| **Calibration number** | Sample report number |
| **Calibration method** | D01 |
| **Performed by** | ADM |
| **Authorized by** | Morten Lillholm |
| | Morten Birkerod Lillholm |
| **Date Received** | 2022-04-11 |
| **Date of calibration** | 2022-04-11 |
| **Date of certificate** | 2022-08-24 |

The laboratory is accredited by DANAK, the national accreditation body in Denmark, according to the requirements in ISO/IEC 17025. The results presented in this report relate only to the items calibrated. This report shall not be reproduced except in full without approval of the laboratory.

# Calibration Details

Values expressed in [%] or [ppm] are relative to the full scale value. 1 ppm = 0.0001%.

The measured quantity is current expressed as the deviation (error) between the current indicated (reading) by the device under test (DUT) and the measured reference current. The indicated current is calculated from the secondary output (current or voltage) of the DUT and the nominal transfer ratio of the device, as provided by the customer or the datasheet of the DUT.

| Quantity | Definition |
|---|---|
| $I_{set}$ | Reference current |
| $I_{rdg}$ | DUT current reading |
| $I_{rdg}(0)$ | DUT offset current |
| $I_{FS}$ | Nominal full scale current |
| $I_U$ | Uncertainty in ampere |
| $I_{tol}$ | Specified tolerance (specification) of error |
| $I_{linreg}$ | Linear regression of error current (Least squares method) |

## Comments

Sample report: Based on simulated data

## Extent of Calibration

Full scale current: 10000.0 A dc
Range: [-10000 A; 10000 A]

## Environment Conditions

Ambient temperature 23 ± 2 °C, relative humidity <75%.

## Uncertainty of Measurement

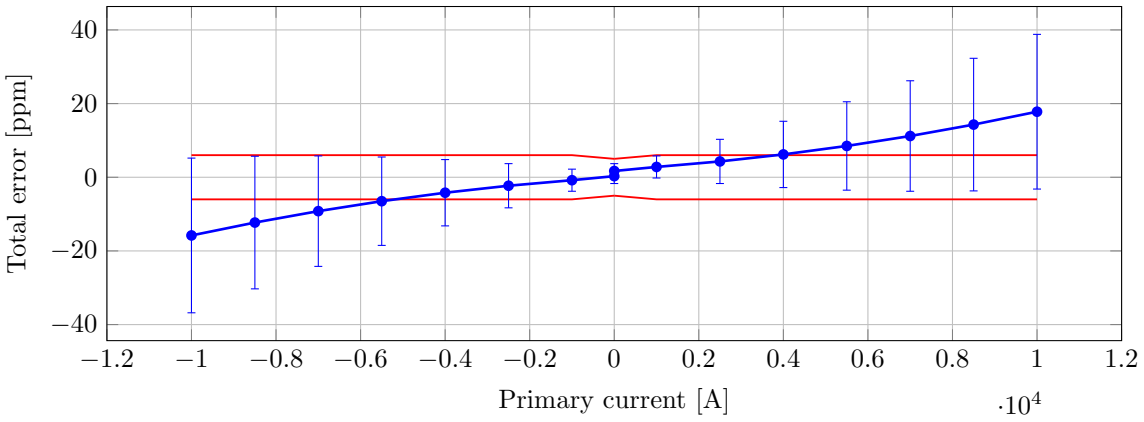
The uncertainty is based on the expanded uncertainty of measurement. Stated as the combined standard uncertainty multiplied by a coverage factor K=2 (Level of confidence at 95 percent). Error bars on graph show confidence interval of measurement points.

## Instruments Used for Calibration

| Danisense ID | Type | Description | Cal.due |
|---|---|---|---|
| 100-250 | Danisense DS REF DCCT | High Precision REF DCCT | 2022-07-15 |
| 104 | Resistor | 1000R | 2023-01-03 |
| 110 | Resistor | 0R25 | None |
| 59 | Keysight 3458A | 8.5 digit multimeter | 2022-11-25 |
| 60 | Keysight 3458A | 8.5 digit multimeter | 2022-11-24 |
| 63 | Magna-power TSA5-1800/380 | Current source | None |

## Total Error

Total error, no offset corrections. Values expressed in [ppm] are relative to the full scale value of $I_{FS}$ = 10000.0 A dc. 1 ppm = 0.0001%.




| Current $I_{set}$ [A] | Reading $I_{rdg}$ [A] | Error $\frac{I_{rdg}-I_{set}}{I_{FS}}$ [ppm] | Uncertainty $\frac{I_U}{I_{FS}}$ [ppm] | Specification $\frac{I_{tol}}{I_{FS}}$ [ppm] | Note |
|---|---|---|---|---|---|
| 0 | 0.017 | 1.7 | 2 | 5.0 | * |
| 1000 | 1000.028 | 2.8 | 3 | 6.0 | * |
| 2500 | 2500.043 | 4.3 | 6 | 6.0 | ** |
| 4000 | 4000.062 | 6.2 | 9 | 6.0 | **** |
| 5500 | 5500.085 | 8.5 | 12 | 6.0 | **** |
| 7000 | 7000.112 | 11.2 | 15 | 6.0 | **** |
| 8500 | 8500.143 | 14.3 | 18 | 6.0 | **** |
| 10000 | 10000.178 | 17.8 | 21 | 6.0 | **** |
| 0 | 0.003 | 0.3 | 2 | 5.0 | * |
| -1000 | -1000.008 | -0.8 | 3 | 6.0 | * |
| -2500 | -2500.023 | -2.3 | 6 | 6.0 | ** |
| -4000 | -4000.042 | -4.2 | 9 | 6.0 | **** |
| -5500 | -5500.065 | -6.5 | 12 | 6.0 | **** |
| -7000 | -7000.092 | -9.2 | 15 | 6.0 | **** |
| -8500 | -8500.123 | -12.3 | 18 | 6.0 | **** |
| -10000 | -10000.158 | -15.8 | 21 | 6.0 | **** |

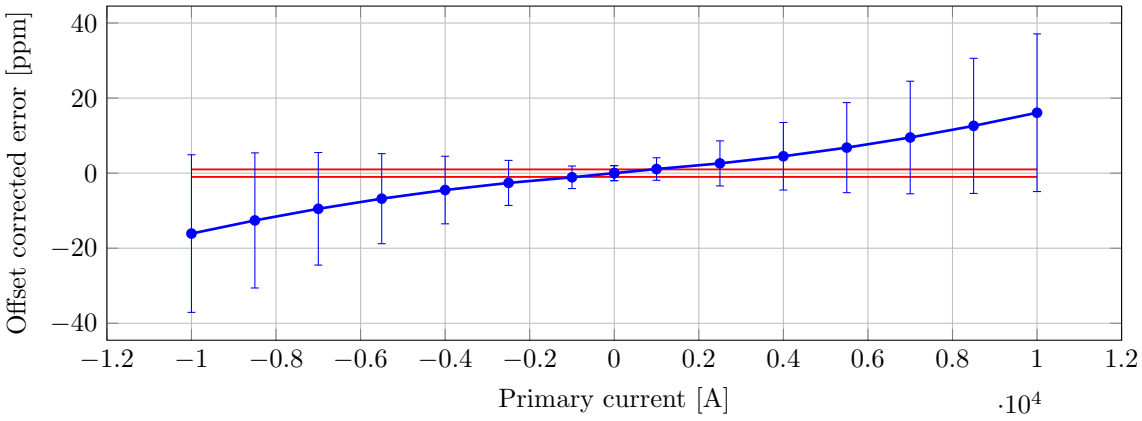
### Measurement Notes

Non-binary statement with measurement uncertainty as guard band according to ILAC-G8:09/2019.

| | |
|---|---|
| * | Pass: Result is within the specification minus the measurement uncertainty. |
| ** | Conditional pass: Result is within the specification, but the result plus measurement uncertainty is outside the specification |
| *** | Conditional fail: Result is outside the specification, but the result minus measurement uncertainty is inside the specification |
| **** | No statement: Result is inside the specification, but the measurement uncertainty is larger than the specification. |
| F | Fail: Result minus measurement uncertainty is outside the specification. |

## Total Error Without Offset

Total error, corrected for offset. Values expressed in [ppm] are relative to the full scale value of $I_{FS}$ = 10000.0 A dc. 1 ppm = 0.0001%.




| Current $I_{set}$ [A] | Reading $I_{rdg} - I_{rdg}(0)$ [A] | Error $\frac{I_{rdg}-I_{rdg}(0)-I_{set}}{I_{FS}}$ [ppm] | Uncertainty $\frac{I_U}{I_{FS}}$ [ppm] | Specification $\frac{I_{tol}}{I_{FS}}$ [ppm] | Note |
|---|---|---|---|---|---|
| 0 | 0.0 | 0.0 | 2 | 1.0 | **** |
| 1000 | 1000.011 | 1.1 | 3 | 1.0 | **** |
| 2500 | 2500.026 | 2.6 | 6 | 1.0 | **** |
| 4000 | 4000.045 | 4.5 | 9 | 1.0 | **** |
| 5500 | 5500.068 | 6.8 | 12 | 1.0 | **** |
| 7000 | 7000.095 | 9.5 | 15 | 1.0 | **** |
| 8500 | 8500.126 | 12.6 | 18 | 1.0 | **** |
| 10000 | 10000.161 | 16.1 | 21 | 1.0 | **** |
| 0 | 0.0 | 0.0 | 2 | 1.0 | **** |
| -1000 | -1000.011 | -1.1 | 3 | 1.0 | **** |
| -2500 | -2500.026 | -2.6 | 6 | 1.0 | **** |
| -4000 | -4000.045 | -4.5 | 9 | 1.0 | **** |
| -5500 | -5500.068 | -6.8 | 12 | 1.0 | **** |
| -7000 | -7000.095 | -9.5 | 15 | 1.0 | **** |
| -8500 | -8500.126 | -12.6 | 18 | 1.0 | **** |
| -10000 | -10000.161 | -16.1 | 21 | 1.0 | **** |

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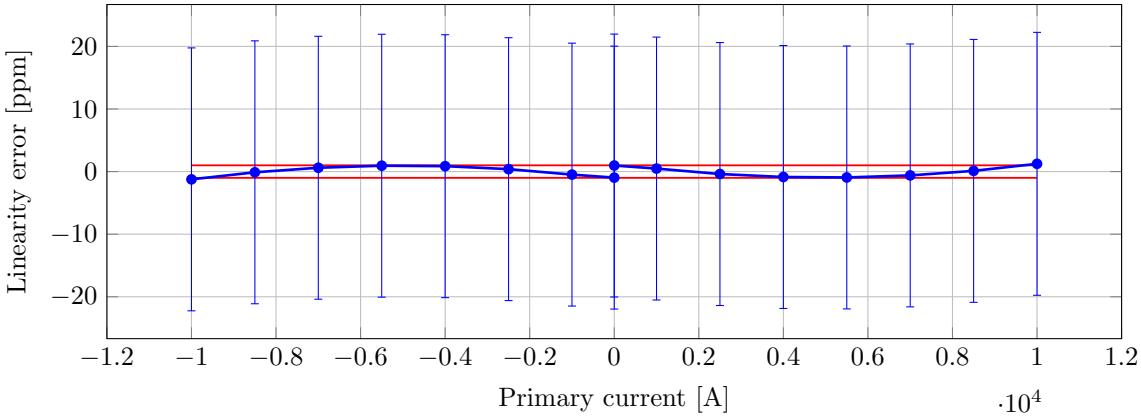
| *** | Conditional fail: Result is outside the specification, but the result minus measurement uncertainty is inside the specification |
| **** | No statement: Result is inside the specification, but the measurement uncertainty is larger than the specification. |
| F | Fail: Result minus measurement uncertainty is outside the specification. |

## Linearity Error

Total error corrected for offset and best fit linear regression, $I_{linreg}$. Values expressed in [ppm] are relative to the full scale value $I_{FS}$ = 10000.0 A dc. 1 ppm = 0.0001%.




| Current $I_{set}$ [A] | Reading $I_{rdg} - I_{rdg}(0)$ [A] | Error $\frac{I_{rdg}-I_{rdg}(0)-I_{linreg}}{I_{FS}}$ [ppm] | Uncertainty $\frac{I_U}{I_{FS}}$ [ppm] | Specification $\frac{I_{tol}}{I_{FS}}$ [ppm] | Note |
|---|---|---|---|---|---|
| 0 | 0.0 | 1.0 | 21 | 1.0 | **** |
| 1000 | 1000.011 | 0.5 | 21 | 1.0 | **** |
| 2500 | 2500.026 | -0.4 | 21 | 1.0 | **** |
| 4000 | 4000.045 | -0.9 | 21 | 1.0 | **** |
| 5500 | 5500.068 | -0.9 | 21 | 1.0 | **** |
| 7000 | 7000.095 | -0.6 | 21 | 1.0 | **** |
| 8500 | 8500.126 | 0.1 | 21 | 1.0 | **** |
| 10000 | 10000.161 | 1.2 | 21 | 1.0 | **** |
| 0 | 0.0 | -1.0 | 21 | 1.0 | **** |
| -1000 | -1000.011 | -0.5 | 21 | 1.0 | **** |
| -2500 | -2500.026 | 0.4 | 21 | 1.0 | **** |
| -4000 | -4000.045 | 0.9 | 21 | 1.0 | **** |
| -5500 | -5500.068 | 0.9 | 21 | 1.0 | **** |
| -7000 | -7000.095 | 0.6 | 21 | 1.0 | **** |
| -8500 | -8500.126 | -0.1 | 21 | 1.0 | **** |
| -10000 | -10000.161 | -1.2 | 21 | 1.0 | **** |

### Measurement Notes

Non-binary statement with measurement uncertainty as guard band according to ILAC-G8:09/2019.

| | |
|---|---|
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| *** | Conditional fail: Result is outside the specification, but the result minus measurement uncertainty is inside the specification |
| **** | No statement: Result is inside the specification, but the measurement uncertainty is larger than the specification. |
| F | Fail: Result minus measurement uncertainty is outside the specification. |

# Terms of Sale and Delivery of Calibration Services

## Application

The general terms of sale and delivery set out below shall apply to all sales and deliveries of Calibration services by DaniSense A/S (the "Seller"), unless otherwise agreed in writing between the Seller and a buyer (separately or collectively referred to as "Party" or "Parties", as the case may be).

## Offers

Offers made by the Seller shall be open for acceptance for 30 days from the date of the offer. An offer will always include a sample report for customer acceptance of actual report content, price with INCOTERMS and lead time from receiving part for calibration.

## Confidentiality

Danisense Calibration is responsible for the management of all information obtained of created during the performance of laboratory activities. All information shared by buyer is considered confidential information. All results are the property of buyer, and seller has no right to disclose any results to third parties, unless agreed upon by the costumer. The measurement results are used by seller for statistical purposes to improve the performance of the calibration lab. Information may be shared with DANAK, the national accreditation body in Denmark without notifying the costumer. If for any reason the seller is required by law or special circumstances to disclose any data, the buyer must be informed in a timely manner. If seller is using sub suppliers for any service, these suppliers are informed about the confidentiality required, but seller will try to avoid disclosing any confidential information to suppliers.

## Delivery

Unless otherwise agreed between the Parties, the goods shall be delivered Ex Works (Incoterms 2010). Delivery is effected at the buyer's expense and risk.

## Disclaimer

The lab is not responsible if information given by the customer alters the validity of the results.