Schmid & Partner Engineering AG

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1236

# IMPORTANT NOTICE

## USAGE OF THE DAE 4

The DAE unit is a delicate, high precision instrument and requires careful treatment by the user. There are no serviceable parts inside the DAE. Special attention shall be given to the following points:

**Battery Exchange**: The battery cover of the DAE4 unit is closed using a screw, over tightening the screw may cause the threads inside the DAE to wear out.

**Shipping of the DAE**: Before shipping the DAE to SPEAG for calibration, remove the batteries and pack the DAE in an antistatic bag. This antistatic bag shall then be packed into a larger box or container which protects the DAE from impacts during transportation. The package shall be marked to indicate that a fragile instrument is inside.

**E-Stop Failures**: Touch detection may be malfunctioning due to broken magnets in the E-stop. Rough handling of the E-stop may lead to damage of these magnets. Touch and collision errors are often caused by dust and dirt accumulated in the E-stop. To prevent E-stop failure, the customer shall always mount the probe to the DAE carefully and keep the DAE unit in a non-dusty environment if not used for measurements.

**Repair**: Minor repairs are performed at no extra cost during the annual calibration. However, SPEAG reserves the right to charge for any repair especially if rough unprofessional handling caused the defect.

**DASY Configuration Files:** Since the exact values of the DAE input resistances, as measured during the calibration procedure of a DAE unit, are not used by the DASY software, a nominal value of 200 MOhm is given in the corresponding configuration file.

**Important Note:**
**Warranty and calibration is void if the DAE unit is disassembled partly or fully by the Customer.**

**Important Note:**
**Never attempt to grease or oil the E-stop assembly. Cleaning and readjusting of the E-stop assembly is allowed by certified SPEAG personnel only and is part of the annual calibration procedure.**

**Important Note:**
**To prevent damage of the DAE probe connector pins, use great care when installing the probe to the DAE. Carefully connect the probe with the connector notch oriented in the mating position. Avoid any rotational movement of the probe body versus the DAE while turning the locking nut of the connector. The same care shall be used when disconnecting the probe from the DAE.**

**Calibration Laboratory of**
Schmid & Partner
Engineering AG
**Zeughausstrasse 43, 8004 Zurich, Switzerland**

S Schweizerischer Kalibrierdienst
C Service suisse d'étalonnage
S Servizio svizzero di taratura
S Swiss Calibration Service

Accredited by the Swiss Accreditation Service (SAS)
**The Swiss Accreditation Service is one of the signatories to the EA Multilateral Agreement for the recognition of calibration certificates**

**Accreditation No.: SCS 108**

**Client** **Huawei - SZ (Auden)**

**Certificate No: DAE4-1236_Nov13**

# CALIBRATION CERTIFICATE

Object: DAE4 - SD 000 D04 BM - SN: 1236

Calibration procedure(s): QA CAL-06.v26
Calibration procedure for the data acquisition electronics (DAE)

Calibration date: November 25, 2013

This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI).
The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

All calibrations have been conducted in the closed laboratory facility: environment temperature (22 ± 3)°C and humidity < 70%.

Calibration Equipment used (M&TE critical for calibration)

| Primary Standards | ID # | Cal Date (Certificate No.) | Scheduled Calibration |
|---|---|---|---|
| Keithley Multimeter Type 2001 | SN: 0810278 | 01-Oct-13 (No:13976) | Oct-14 |
| **Secondary Standards** | **ID #** | **Check Date (in house)** | **Scheduled Check** |
| Auto DAE Calibration Unit | SE UWS 053 AA 1001 | 07-Jan-13 (in house check) | In house check: Jan-14 |
| Calibrator Box V2.1 | SE UMS 006 AA 1002 | 07-Jan-13 (in house check) | In house check: Jan-14 |

| | Name | Function | Signature |
|---|---|---|---|
| Calibrated by: | Eric Hainfeld | Technician | |
| Approved by: | Fin Bomholt | Deputy Technical Manager | |

Issued: November 25, 2013

This calibration certificate shall not be reproduced except in full without written approval of the laboratory.

## Glossary

| | |
|---|---|
| DAE | data acquisition electronics |
| Connector angle | information used in DASY system to align probe sensor X to the robot coordinate system. |

## Methods Applied and Interpretation of Parameters

- *DC Voltage Measurement:* Calibration Factor assessed for use in DASY system by comparison with a calibrated instrument traceable to national standards. The figure given corresponds to the full scale range of the voltmeter in the respective range.
- *Connector angle*: The angle of the connector is assessed measuring the angle mechanically by a tool inserted. Uncertainty is not required.
- The following parameters as documented in the Appendix contain technical information as a result from the performance test and require no uncertainty.
  - *DC Voltage Measurement Linearity:* Verification of the Linearity at +10% and -10% of the nominal calibration voltage. Influence of offset voltage is included in this measurement.
  - *Common mode sensitivity:* Influence of a positive or negative common mode voltage on the differential measurement.
  - *Channel separation:* Influence of a voltage on the neighbor channels not subject to an input voltage.
  - *AD Converter Values with inputs shorted:* Values on the internal AD converter corresponding to zero input voltage
  - *Input Offset Measurement*: Output voltage and statistical results over a large number of zero voltage measurements.
  - *Input Offset Current:* Typical value for information; Maximum channel input offset current, not considering the input resistance.
  - *Input resistance:* Typical value for information: DAE input resistance at the connector, during internal auto-zeroing and during measurement.
  - *Low Battery Alarm Voltage:* Typical value for information. Below this voltage, a battery alarm signal is generated.
  - *Power consumption:* Typical value for information. Supply currents in various operating modes.

## DC Voltage Measurement

A/D - Converter Resolution nominal

| | | | | |
|---|---|---|---|---|
| High Range: | 1LSB = | 6.1μV , | full range = | -100...+300 mV |
| Low Range: | 1LSB = | 61nV , | full range = | -1.....+3mV |

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

| Calibration Factors | X | Y | Z |
|---|---|---|---|
| High Range | 404.968 ± 0.02% (k=2) | 404.890 ± 0.02% (k=2) | 405.887 ± 0.02% (k=2) |
| Low Range | 4.00060 ± 1.50% (k=2) | 3.97527 ± 1.50% (k=2) | 4.00604 ± 1.50% (k=2) |

## Connector Angle

| | |
|---|---|
| **Connector Angle** to be used in DASY system | 304.5 ° ± 1 ° |

## Appendix

### 1. DC Voltage Linearity

| High Range | | Reading (μV) | Difference (μV) | Error (%) |
|---|---|---|---|---|
| Channel X | + Input | 200026.14 | -7.66 | -0.00 |
| Channel X | + Input | 20000.42 | -2.43 | -0.01 |
| Channel X | - Input | -20002.85 | 3.18 | -0.02 |
| Channel Y | + Input | 200027.74 | -11.41 | -0.01 |
| Channel Y | + Input | 20001.04 | -1.84 | -0.01 |
| Channel Y | - Input | -20005.23 | 0.86 | -0.00 |
| Channel Z | + Input | 200031.50 | -1.88 | -0.00 |
| Channel Z | + Input | 19998.79 | -3.98 | -0.02 |
| Channel Z | - Input | -20006.46 | -0.33 | 0.00 |

| Low Range | | Reading (μV) | Difference (μV) | Error (%) |
|---|---|---|---|---|
| Channel X | + Input | 1999.06 | -0.58 | -0.03 |
| Channel X | + Input | 200.68 | 0.81 | 0.40 |
| Channel X | - Input | -199.75 | 0.64 | -0.32 |
| Channel Y | + Input | 2000.27 | 0.72 | 0.04 |
| Channel Y | + Input | 198.44 | -1.31 | -0.66 |
| Channel Y | - Input | -201.14 | -0.78 | 0.39 |
| Channel Z | + Input | 1999.99 | 0.48 | 0.02 |
| Channel Z | + Input | 198.55 | -1.14 | -0.57 |
| Channel Z | - Input | -201.45 | -1.07 | 0.54 |

### 2. Common mode sensitivity

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

| | Common mode Input Voltage (mV) | High Range Average Reading (μV) | Low Range Average Reading (μV) |
|---|---|---|---|
| Channel X | 200 | 17.01 | 15.59 |
| | - 200 | -14.68 | -15.99 |
| Channel Y | 200 | -15.94 | -16.00 |
| | - 200 | 15.24 | 14.93 |
| Channel Z | 200 | -14.16 | -14.15 |
| | - 200 | 11.62 | 11.90 |

### 3. Channel separation

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

| | Input Voltage (mV) | Channel X (μV) | Channel Y (μV) | Channel Z (μV) |
|---|---|---|---|---|
| Channel X | 200 | - | 4.04 | -2.60 |
| Channel Y | 200 | 8.97 | - | 3.71 |
| Channel Z | 200 | 9.63 | 7.80 | - |

## 4. AD-Converter Values with inputs shorted

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

| | High Range (LSB) | Low Range (LSB) |
|---|---|---|
| **Channel X** | 15747 | 16256 |
| **Channel Y** | 16005 | 15408 |
| **Channel Z** | 16294 | 16775 |

## 5. Input Offset Measurement

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec
Input 10MΩ

| | Average (μV) | min. Offset (μV) | max. Offset (μV) | Std. Deviation (μV) |
|---|---|---|---|---|
| **Channel X** | 0.77 | -1.13 | 2.45 | 0.64 |
| **Channel Y** | 0.08 | -1.65 | 2.23 | 0.74 |
| **Channel Z** | -1.01 | -2.28 | 0.73 | 0.55 |

## 6. Input Offset Current

Nominal Input circuitry offset current on all channels: <25fA

## 7. Input Resistance (Typical values for information)

| | Zeroing (kOhm) | Measuring (MOhm) |
|---|---|---|
| **Channel X** | 200 | 200 |
| **Channel Y** | 200 | 200 |
| **Channel Z** | 200 | 200 |

## 8. Low Battery Alarm Voltage (Typical values for information)

| Typical values | Alarm Level (VDC) |
|---|---|
| **Supply (+ Vcc)** | +7.9 |
| **Supply (- Vcc)** | -7.6 |

## 9. Power Consumption (Typical values for information)

| Typical values | Switched off (mA) | Stand by (mA) | Transmitting (mA) |
|---|---|---|---|
| **Supply (+ Vcc)** | +0.01 | +6 | +14 |
| **Supply (- Vcc)** | –0.01 | -8 | -9 |