

Zeughausstrasse 43, 8004 Zurich, Switzerland  
Phone +41 1 245 9700, Fax +41 1 245 9779  
info@speag.com, http://www.speag.com

## **IMPORTANT NOTICE**

### **USAGE OF THE DAE 3**

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 DAE3 unit is connected to a fragile 3-pin battery connector. Customer is responsible to apply outmost caution not to bend or damage the connector when changing batteries.

**Shipping of the DAE:** Before shipping the DAE to SPEAG for calibration Customer shall remove the batteries and pack the DAE in an antistatic bag. The packaging shall protect 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, 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.

**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.**



Accredited by the Swiss Federal Office of Metrology and Accreditation  
**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 **TMC - Auden**

**Certificate No: DAE3-589\_Oct04**

## **CALIBRATION CERTIFICATE**

Object **DAE3 - SD 000 D03 AA - SN: 589**

Calibration procedure(s) **QA CAL-06.v9**  
**Calibration procedure for the data acquisition unit (DAE)**

Calibration date: **October 21, 2004**

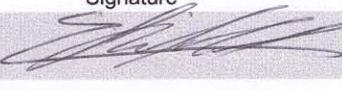
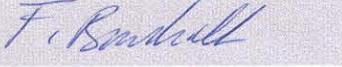
Condition of the calibrated item **In Tolerance**

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  $(22 \pm 3)^\circ\text{C}$  and humidity  $< 70\%$ .

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Calibrated by, Certificate No.)	Scheduled Calibration
Fluke Process Calibrator Type 702	SN: 6295803	7-Sep-04 (Sintrel, No.E-040073)	Sep-05
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Calibrator Box V1.1	SE UMS 006 AB 1002	16-Jul-04 (SPEAG, in house check)	In house check Jul-05

Calibrated by:	Name Eric Hainfeld	Function Technician	Signature 
Approved by:	Fin Bomholt	R&D Director	

Issued: October 21, 2004

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



Accredited by the Swiss Federal Office of Metrology and Accreditation  
The Swiss Accreditation Service is one of the signatories to the EA  
Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: SCS 108

## Glossary

DAE	digital 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 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*: 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 =  $6.1\mu\text{V}$ , full range =  $-100...+300\text{ mV}$

Low Range: 1LSB =  $61\text{nV}$ , full range =  $-1.....+3\text{mV}$

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

Calibration Factors	X	Y	Z
High Range	$404.971 \pm 0.1\% \text{ (k=2)}$	$404.426 \pm 0.1\% \text{ (k=2)}$	$403.726 \pm 0.1\% \text{ (k=2)}$
Low Range	$3.96102 \pm 0.7\% \text{ (k=2)}$	$3.94628 \pm 0.7\% \text{ (k=2)}$	$3.93824 \pm 0.7\% \text{ (k=2)}$

## Connector Angle

Connector Angle to be used in DASY system	$125^\circ \pm 1^\circ$
---	-------------------------

## Appendix

### 1. DC Voltage Linearity

High Range		Input (μV)	Reading (μV)	Error (%)
Channel X	+ Input	200000	199999.6	0.00
Channel X	+ Input	20000	20002.14	0.01
Channel X	- Input	20000	-19995.10	-0.02
Channel Y	+ Input	200000	199999.5	0.00
Channel Y	+ Input	20000	20002.95	0.01
Channel Y	- Input	20000	-19993.60	-0.03
Channel Z	+ Input	200000	200000.6	0.00
Channel Z	+ Input	20000	20001.27	0.01
Channel Z	- Input	20000	-19993.22	-0.03

Low Range		Input (μV)	Reading (μV)	Error (%)
Channel X	+ Input	2000	2000.1	0.00
Channel X	+ Input	200	200.51	0.25
Channel X	- Input	200	-200.84	0.42
Channel Y	+ Input	2000	2000	0.00
Channel Y	+ Input	200	199.29	-0.36
Channel Y	- Input	200	-200.74	0.37
Channel Z	+ Input	2000	1999.9	0.00
Channel Z	+ Input	200	199.61	-0.19
Channel Z	- Input	200	-201.95	0.97

### 2. Common mode sensitivity

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

	Common mode Input Voltage (mV)	High Range Reading (μV)	Low Range Reading (μV)
Channel X	200	-0.45	-0.89
	-200	2.23	1.38
Channel Y	200	-0.39	-1.29
	-200	-0.29	-0.77
Channel Z	200	10.78	9.82
	-200	-11.98	-12.01

### 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	-	2.71	-1.77
Channel Y	200	0.58	-	4.17
Channel Z	200	-2.12	-0.75	-

#### 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	16208	16581
Channel Y	16109	16335
Channel Z	15996	16695

#### 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	-0.35	2.88	0.40
Channel Y	-1.48	-3.11	0.42	0.41
Channel Z	-0.02	-1.35	1.77	0.45

#### 6. Input Offset Current

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

#### 7. Input Resistance

	Zeroing (MOhm)	Measuring (MOhm)
Channel X	0.2001	196.7
Channel Y	0.2000	199.1
Channel Z	0.2001	198.7

#### 8. Low Battery Alarm Voltage

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

#### 9. Power Consumption

Typical values	Switched off (mA)	Stand by (mA)	Transmitting (mA)
Supply (+ Vcc)	+0.0	+6	+14
Supply (- Vcc)	-0.01	-8	-9