



Calibration Certificate of DASY

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



S Schweizerischer Kalibrierdienst
C Service suisse d'étalonnage
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Client Sporton (Auden)

Accreditation No.: SCS 108

Certificate No: AM1DV2-1038_Jan09

CALIBRATION CERTIFICATE

Object	AM1DV2 - SN: 1038
Calibration procedure(s)	QA CAL-24.v2 Calibration procedure for AM1D magnetic field probes and TMFS in the audio range
Calibration date:	January 12, 2009
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 (Certificate No.)	Scheduled Calibration
Keithley Multimeter Type 2001	SN: 0810278	30-Sep-08 (No: 7670)	Sep-09
Reference Probe AM1DV2	SN: 1008	12-Jan-09 (No. AM1D-1008_Jan09)	Jan-10
DAE4	SN: 781	03-Oct-08 (No. DAE4-781_Oct08)	Oct-09
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
AMCC	1050	15-Aug-08 (in house check Aug-08)	Aug-09

Calibrated by:	Name	Function	Signature
	Mike Meili	RF Technician	
Approved by:	Fin Bomholt	R&D Director	

Issued: January 13, 2009

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Client Sporton (Auden)

Certificate No: DAE3-577_Nov08

CALIBRATION CERTIFICATE

Object DAE3 - SD 000 D03 AA - SN: 577

Calibration procedure(s) QA CAL-06.v12
Calibration procedure for the data acquisition electronics (DAE)

Calibration date: November 12, 2008

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 ± 3)°C and humidity < 70%.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Fluke Process Calibrator Type 702	SN: 6295803	30-Sep-08 (No: 7673)	Sep-09
Keithley Multimeter Type 2001	SN: 0810278	30-Sep-08 (No: 7670)	Sep-09
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Calibrator Box V1.1	SE UMS 006 AB 1004	06-Jun-08 (in house check)	In house check: Jun-09

Calibrated by:	Name Andrea Guntli	Function Technician	Signature
Approved by:	Fin Bomholt	R&D Director	

Issued: November 12, 2008

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Accreditation No.: **SCS 108**

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*: 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.



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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 = 61nV , 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	$404.437 \pm 0.1\% \text{ (k=2)}$	$403.882 \pm 0.1\% \text{ (k=2)}$	$404.321 \pm 0.1\% \text{ (k=2)}$
Low Range	$3.93985 \pm 0.7\% \text{ (k=2)}$	$3.94699 \pm 0.7\% \text{ (k=2)}$	$3.94542 \pm 0.7\% \text{ (k=2)}$

Connector Angle

Connector Angle to be used in DASY system	$268^\circ \pm 1^\circ$
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Appendix

1. DC Voltage Linearity

High Range		Input (µV)	Reading (µV)	Error (%)
Channel X	+ Input	200000	200000.5	0.00
Channel X	+ Input	20000	20006.28	0.03
Channel X	- Input	20000	-19997.96	-0.01
Channel Y	+ Input	200000	199999.8	0.00
Channel Y	+ Input	20000	20003.35	0.02
Channel Y	- Input	20000	-20003.31	0.02
Channel Z	+ Input	200000	200000.3	0.00
Channel Z	+ Input	20000	20006.28	0.03
Channel Z	- Input	20000	-19999.42	0.00

Low Range		Input (µV)	Reading (µV)	Error (%)
Channel X	+ Input	2000	2000	0.00
Channel X	+ Input	200	200.64	0.32
Channel X	- Input	200	-199.61	-0.19
Channel Y	+ Input	2000	2000	0.00
Channel Y	+ Input	200	199.39	-0.31
Channel Y	- Input	200	-201.03	0.52
Channel Z	+ Input	2000	2000	0.00
Channel Z	+ Input	200	199.42	-0.29
Channel Z	- Input	200	-200.73	0.36

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	13.38	13.83
	-200	-13.53	-13.82
Channel Y	200	-5.55	-6.09
	-200	5.06	5.66
Channel Z	200	-1.00	-0.72
	-200	-0.80	-0.52

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	-	1.66	0.50
Channel Y	200	1.90	-	3.95
Channel Z	200	-0.95	0.48	-



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	15967	16080
Channel Y	15851	16385
Channel Z	16197	16100

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	1.13	-1.22	2.29	0.58
Channel Y	-1.51	-2.99	0.83	0.52
Channel Z	0.02	-0.89	0.92	0.38

6. Input Offset Current

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

7. Input Resistance

	Zeroing (MΩ)	Measuring (MΩ)
Channel X	0.2000	198.6
Channel Y	0.2001	199.4
Channel Z	0.2000	198.8

8. Low Battery Alarm Voltage (verified during pre test)

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

9. Power Consumption (verified during pre test)

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



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Certificate of conformity

Item	Audio Magnetic Calibration Coil AMCC
Type No	SD HAC P02 A
Series No	1001 ff.
Manufacturer / Origin	Schmid & Partner Engineering AG Zurich, Switzerland

Description of the item

The Audio Magnetic Calibration coil (AMCC) is a Helmholtz Coil designed according to standard [1], section D.9 for calibration of the AM1D probe. Two horizontal coils are positioned above a non-metallic base plate and generate a homogeneous magnetic field in the z direction (normal to it).

Configuration

The AMCC consists of two parallel coils of 20 turns with radius 143 mm connected in parallel in a distance of 143 mm. With this design, a current of 10 mA produces a field of 1 A/m. The DC input resistance at the input BNC socket is adjusted by a series resistor to a DC resistance of approximately 50 Ohm. The voltage required to produce a field of 1 A/m is consequently approx. 500 mV.

To current through the coil is monitored via a shunt resistor of 10 Ohm +/- 1%. The voltage is available on a BNO socket with 100 mV corresponding to 1 A/m.

Handling of the item

The coil shall be positioned in a non-metallic environment to avoid distortion of the magnetic field.

Tests

Test	Requirement	Details	Units tested
Number of turns	N = 20 per coil	Resistance measurement	all
Orientation of coils	parallel coils with same direction of windings	Magnetic field variation in the AMCC axis	all
Coil radius	r = 143 mm	mechanical dimension	First article
Coil distance	d = 143 mm distance between coil centers	mechanical dimension	First article
Input resistance	51.7 +/- 2 Ohm	DC resistance at BNC input connector	all
Shunt resistance	R = 10.0 Ohm +/- 1 %	DC resistance at BNO output connector	all
Shunt sensitivity	Hc = 1 A/m per 100 mV according to formula Hc = (U / R) * N / r / (1.25^1.5)	Field measurement compared with Narda ELT400 + BN2300/90.10	First article

Standards

[1] ANSI PC63.19-2006 Draft 3.12

Conformity

Based on the tests above, we certify that this item is in compliance with the requirements of [1].

Date

22.5.2006

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Stamp / Signature

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