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Certificate of calibration

The measurements, the uncertainties with confidence probability and calibration methods are given on the following page and are part of the certificate.
This certificate shall not be published or reproduced other than in full.

Certificate no. 136-32603

Object   Surface Velocity Radar

Identification no.	07151413	Interface	
Measuring range	0...5 m/s	Display Resolution	0.001
Manufacturer	Sommer GmbH	Type	RG-30

Client   Sommer GmbH , 6842 Koblach, Austria

Last calibration   First calibration

Remarks   - up to 1.5 m/s, Measuring time of 15 s
- starting from 2.0 m/s, Measuring time of 5 s
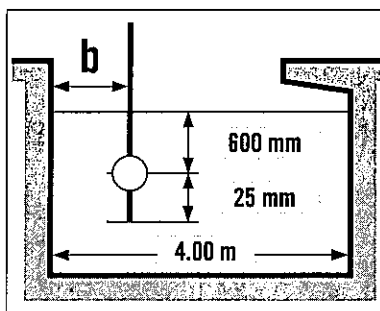
Annex to   Annex A

Date of issue   11.3.2015

Head of the Laboratory   Dr. Marc de Huu

This certificate is consistent with Calibration and Measurement Capabilities (CMCs) that are included in Appendix C of the Mutual Recognition Arrangement (MRA) drawn up by the International Committee for Weights and Measures. Under the MRA, all participating institutes recognize the validity of each other's calibration certificates and measurement reports for the quantities, ranges and measurement uncertainties specified in Appendix C (for details see www.bipm.org).

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Fact sheet

Calibr. apparatus

Attachment: Rail

Water temperature: 12.9 ±0.5 °C

Measuring conditions   Dead time: 0 s   Time for a partial measurement: 10 s

The dead time is the predetermined time needed by the system to stabilize itself after the reference velocity has been attained. The values, indicated in red, are measured values before the dead time was over. They are not used for the analysis. v-ref = reference velocity; U = Uncertainty of measurement 95% (see last page). D = eventually added document (electronically).

Measurement Results

Position b [mm]	Date	Start Time	No. of measure	v-ref [m/s]	Object tested Display [m/s]	U [m/s]	U [%]
2690	19.2.2015	14:07:07	9	0.20020	0.2370	0.02493	10.52
2690	19.2.2015	14:13:29	9	0.40030	0.4186	0.00843	2.01
2690	19.2.2015	14:20:20	5	0.70050	0.7244	0.00791	1.09
2690	19.2.2015	14:29:57	3	1.00040	1.0390	0.01128	1.09
2690	19.2.2015	14:35:56	3	1.50070	1.5360	0.01641	1.07
2690	19.2.2015	14:40:31	2	1.50070	1.5390	0.00965	0.63
2690	19.2.2015	15:00:41	4	2.00050	2.0620	0.02386	1.16
2690	19.2.2015	15:04:53	3	2.99990	3.1113	0.03883	1.25
2690	19.2.2015	15:10:11	3	3.00010	3.0537	0.03366	1.10

Measurement report

Results with list of values obtained	Position b [mm]	Date	Start Time	No. of measure	v-ref [m/s]	Display [m/s]	Object tested U [m/s]	U [%]
	2690	19.2.2015	14:07:07	9	0.20020	0.2370	0.02493	10.52

	1	2	3	4	5	6	7	8	9
v-ref [m/s]	0.20020	0.20020	0.20020	0.20020	0.20020	0.20020	0.20020	0.20020	0.20020
Display [m/s]	0.269	0.253	0.230	0.232	0.229	0.226	0.228	0.226	0.240

	Position b [mm]	Date	Start Time	No. of measure	v-ref [m/s]	Display [m/s]	Object tested U [m/s]	U [%]
	2690	19.2.2015	14:13:29	9	0.40030	0.4186	0.00843	2.01

	1	2	3	4	5	6	7	8	9
v-ref [m/s]	0.40030	0.40030	0.40030	0.40030	0.40030	0.40030	0.40030	0.40030	0.40030
Display [m/s]	0.426	0.421	0.420	0.421	0.412	0.418	0.418	0.416	0.415

	Position b [mm]	Date	Start Time	No. of measure	v-ref [m/s]	Display [m/s]	Object tested U [m/s]	U [%]
	2690	19.2.2015	14:20:20	5	0.70050	0.7244	0.00791	1.09

	1	2	3	4	5
v-ref [m/s]	0.70050	0.70050	0.70050	0.70050	0.70050
Display [m/s]	0.723	0.719	0.723	0.732	0.725

	Position b [mm]	Date	Start Time	No. of measure	v-ref [m/s]	Display [m/s]	Object tested U [m/s]	U [%]
	2690	19.2.2015	14:29:57	3	1.00040	1.0390	0.01128	1.09

	1	2	3
v-ref [m/s]	1.00040	1.00040	1.00040
Display [m/s]	1.027	1.046	1.044

	Position b [mm]	Date	Start Time	No. of measure	v-ref [m/s]	Display [m/s]	Object tested U [m/s]	U [%]
	2690	19.2.2015	14:35:56	3	1.50070	1.5360	0.01641	1.07

	1	2	3
v-ref [m/s]	1.50070	1.50070	1.50070
Display [m/s]	1.549	1.521	1.538

	Position b [mm]	Date	Start Time	No. of measure	v-ref [m/s]	Display [m/s]	Object tested U [m/s]	U [%]
	2690	19.2.2015	14:40:31	2	1.50070	1.5390	0.00965	0.63

	1	2
v-ref [m/s]	1.50070	1.50070
Display [m/s]	1.547	1.531

Measurement report

Results with list of values obtained	Position b [mm]	Date	Start Time	No. of measure	v-ref [m/s]	Object tested Display [m/s]	U [m/s]	U [%]
	2690	19.2.2015	15:00:41	4	2.00050	2.0620	0.02386	1.16

	1	2	3	4
v-ref [m/s]	2.00050	2.00050	2.00050	2.00050
Display [m/s]	2.088	2.062	2.047	2.051

	Position b [mm]	Date	Start Time	No. of measure	v-ref [m/s]	Object tested Display [m/s]	U [m/s]	U [%]
	2690	19.2.2015	15:04:53	3	2.99990	3.1113	0.03883	1.25

	1	2	3
v-ref [m/s]	2.99990	2.99990	2.99990
Display [m/s]	3.137	3.127	3.070

	Position b [mm]	Date	Start Time	No. of measure	v-ref [m/s]	Object tested Display [m/s]	U [m/s]	U [%]
	2690	19.2.2015	15:10:11	3	3.00010	3.0537	0.03366	1.10

	1	2	3
v-ref [m/s]	3.00010	3.00010	3.00010
Display [m/s]	3.073	3.015	3.073

Precision

Measuring method	The measuring instrument is mounted on the tow carriage above the tank and towed through still water at a constant speed (reference velocity, v-ref). The measured values are stored up in the measuring instrument. The stored values are read out and entered into the certificate.
Measurement Uncertainty	The reported uncertainty of measurement is stated as the combined standard uncertainty multiplied by a coverage factor k = 2. The measured value (y) and the associated uncertainty (U) represent the interval (y +/- U) which contains the value of the measured quantity with a probability of approximately 95 %. The uncertainty was estimated following the guidelines of the ISO (GUM:1995).
Traceability	The reported measurement values are traceable to national standards and thus to internationally supported realizations of the SI-units.

Date of calibration   19.2.2015

For the measurement   Beat Wüthrich

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Diagram

Appendix to Certificate No. 136-32603
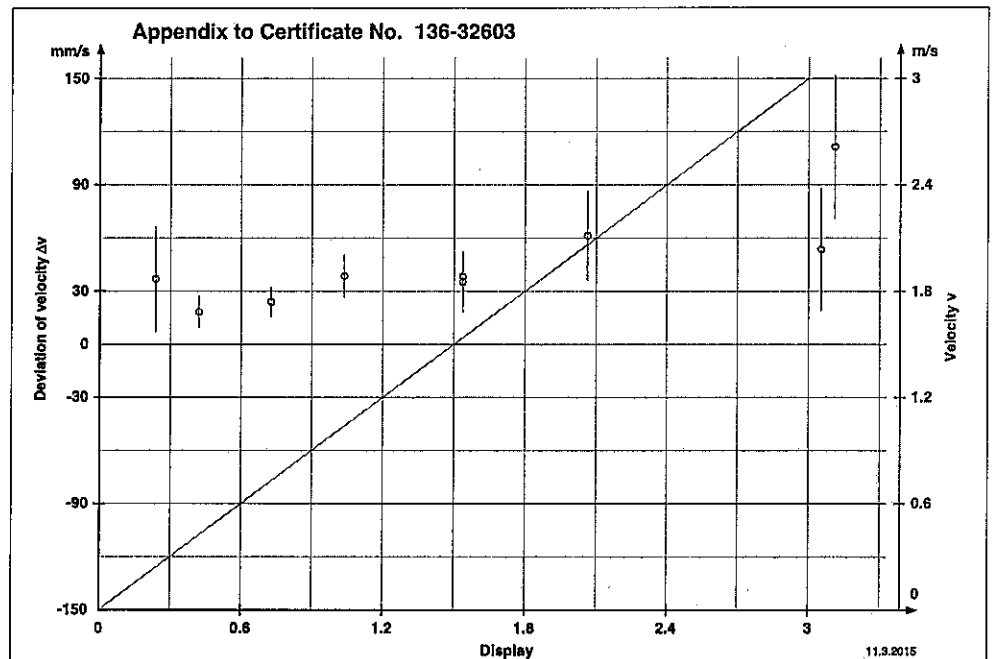
Description of diagram   The graphic shows up that a band of variability is illustrated to each measuring point which is determined by the partial measuring. This band of variability represents the whole uncertainty of measuring caused by the instrument which has to be calibrated as well as by the fixation and the calibration Laboratory. The so-called "Eppereffect" may appear in the range of speed from v = 3.0 m/s up to 4.5 m/s.

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