

ISO 22013:2021 (E)

Marine environment sensor performance — Specifications, testing and reporting — General requirements

Contents

	Foreword
	Introduction
1	Scope
2	Normative references
3	Terms and definitions
4	Specifications
4.1	General
4.2	Calibration
4.3	Range
4.3.1	Calibrated range
4.3.2	Measuring range
4.3.3	Maximum range
4.4	Accuracy
4.5	Resolution
4.6	Response time
4.7	Depth and pressure
4.7.1	Maximum depth rating
4.7.2	Crush depth rating
4.8	Sample rate
4.9	Mechanical
4.9.1	Wetted materials
4.9.2	Exterior dimensions
4.9.3	Mass or weight in air
4.9.4	Weight in freshwater
4.9.5	Weight in seawater
4.9.6	Operating temperature range
4.10	Electrical
4.10.1	Input voltage range
4.10.2	Operating power consumption
4.10.3	Startup power consumption
4.11	Interface
4.11.1	Electrical connections
4.11.2	Communications protocol
4.12	Stability
4.13	Shelf-life
5	Test methods
5.1	Overview
5.2	General experimental design
5.2.1	General
5.2.2	Sensor settings
5.2.3	Reference
5.2.4	Re-calibration
5.3	Calibration
5.3.1	General
5.3.2	Calibration method
5.3.3	Experimental design — Layout of the calibration
5.3.3.1	Number of levels and calibrated range

5.3.3.2	Reference
5.3.4	Calibration curve
5.3.5	Post-calibration operations
5.4	Accuracy
5.4.1	General
5.4.2	Modifications to ISO 5725
5.4.2.1	General
5.4.2.2	Inter-sensor variability
5.4.3	Statistical model
5.4.4	Determination of precision
5.4.4.1	General
5.4.4.2	Repeatability conditions
5.4.4.3	Reproducibility conditions
5.4.5	Experimental design — Layout of the precision experiment
5.4.5.1	Number of sensors
5.4.5.2	Number of levels and range
5.4.5.3	Environmental conditions
5.4.5.4	Number of replicates
5.4.5.5	Calibration of sensors
5.4.6	Reference
5.4.7	Determination of trueness (bias)
5.4.8	Statistical analysis
5.4.8.1	Precision
5.4.8.2	Trueness
5.5	Resolution
5.5.1	General
5.5.2	Experimental design
5.5.3	Calculation of s noise
5.5.4	Calculation of s noise ij
5.6	Response time
5.6.1	General
5.6.2	Experimental design
5.6.2.1	General
5.6.2.2	Medium
5.6.2.3	Sample period
5.6.2.4	Flow
5.6.2.5	Step change
5.6.3	Response curve
5.6.3.1	General
5.6.3.2	Determination of the response curve
5.6.3.3	Determination without experiment
5.6.3.4	Calculation of t_{63}
5.7	Depth and pressure
5.7.1	Maximum depth rating
5.7.2	Crush depth rating
5.7.3	Pressure case void
5.8	Mechanical
5.8.1	Wetted materials
5.8.2	Weight in freshwater
5.8.3	Weight in seawater
5.8.4	Operating temperature range
5.9	Electrical
5.9.1	Input voltage range
5.9.2	Operating power consumption
5.9.3	Startup power consumption
5.10	Interface
5.10.1	General
5.10.2	Power on/standby
5.10.3	Galvanic isolation test
5.11	Stability
5.11.1	General
5.11.2	Experimental design
5.11.3	Calculation of d
5.11.4	Field stability

- 5.11.4.1 General
- 5.11.4.2 Guidelines on determination
- 5.11.4.3 Publication
- 5.12 Shelf-life
- 5.12.1 General
- 5.12.2 Experimental design
- 5.12.3 Calculation of d

6 Publication

- 6.1 General
- 6.2 Data sheets
- 6.2.1 General
- 6.2.2 Test reports
- 6.3 Calibration certificates

Annex A (informative) Determination of the accuracy (precision and trueness) — Example

- A.1 Description
- A.2 Precision assessment
 - A.2.1 Cell means
 - A.2.2 Computation of standard deviations
 - A.2.3 Scrutiny for consistency and outliers
 - A.2.4 Computation of s_{rj} , s_{Rj}
 - A.2.5 Dependence of precision on m
 - A.2.6 Conclusions
- A.3 Trueness assessment
 - A.3.1 Estimation of the bias
 - A.3.2 Variation of the bias
 - A.3.3 95 % confidence interval for the bias
 - A.3.4 Significance of the bias
 - A.3.5 Conclusion

Annex B (informative) Determination of the response time — Examples

- B.1 Example determination of response time for a sound velocity sensor
 - B.1.1 Description
 - B.1.2 Developing the model
 - B.1.3 Calculation of t_{63}
 - B.1.4 Conclusion
- B.2 Example determination of the response time for a dissolved carbon dioxide sensor
 - B.2.1 Description
 - B.2.2 Scrutiny of the step experiment
 - B.2.2.1 Sample period
 - B.2.2.2 Speed
 - B.2.2.3 Levels
 - B.2.2.4 Continuity
 - B.2.2.5 Flow
 - B.2.3 Results
 - B.2.4 Rising step
 - B.2.5 Calculation of t_{63}
 - B.2.6 Conclusion

Annex C (informative) Data sheet for a sound velocity sensor — Example