NCSLI Membership Survey

RP-1 (Establishing and Adjusting Calibration Intervals)

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- Presented by the 173 Metrology Practices Committee

Abstract

- Calibration program costs come under constant management scrutiny–calibration frequency drives much of the program cost.
- In 2010, the 173 Metrology Practices Committee (MPC) issued Edition 4 of its calibration interval recommended practice.
- In 2013 MPC surveyed the members on the RP.
- 92 members responded.
- This session presents the results.

Learning Objectives

- Become aware of RP-1
- Hear membership perspectives on RP-1.
- Understand some of its importance to program managers and the support it provides to potential technical developers of a program.

NCSLI Support

- The survey depended on the support and assistance of NCSLI staff – Craig Gulka and Linda Stone.
- The NCSLI office issued it on the Internet in Survey Monkey format.

RP-1 Summary

- The RP provides comprehensive guidance on calibration intervals for multiple metrology roles.
- The early parts of the document outline the general aspects of an interval calibration program and the factors important to management.
- The latter part of the document details what is a technical developer should know to implement an calibration interval program.

Purpose of calibration intervals

- We often think that calibration interval analysis seeks to eliminate of out-of-tolerance conditions.
- The actual principal goal, which has evolved from the discipline's inception: Limiting the use of out-of-tolerance attributes to an acceptable level.

Evolution

- Any program, should assign an initial interval to instruments by some method or classification scheme.
- Instruments age, conditions change, data accumulates.
- Over time, the program should reevaluate for appropriateness and adjust intervals.

Considerations

- No “one size fits all” exists.
- Primary factors include cost effectiveness, system responsiveness to changing conditions and the ease of use and implementation of the method used.
- Other factors include workload, size of inventory, importance of quality and the data available.

Survey Content (33 questions)

- General
  - Type of business (3)
  - IA policy (6)
  - IA documents (3)
  - Equip. inventory (4)
  - Likes, dislikes (2)
  - General comments (1)
- Implementation
  - Records & data (5)
  - Software & training (2)
  - Intervals & units (4)
  - IA Methods (2)
  - Reliability targets (2)
  - IA obstacles (1)

Industry Response (self ID'd)

Industry	Number	Percentage
Medical	27	18%
Air and Space	23	15%
Utility/Energy	14	9%
Government & Defense	19	13%
Testing	10	7%
Automotive, Bio and Life Science Chemical Industry, Communications & Telecom Electronics, Evnironment, Heavy Industry Food & Beverage, Febrics, Education, HVAC	59	< 5% ea.
Totals	152	100%

Business Types

- Calibration interval involvement
  - 81 Provide internal calibration services
  - 62 Purchase or outsource cal. services
  - 46 Sell calibration services
- Wide variety of measurement disciplines

Members who have any RP edition

Number	Percentage	
68	74 %	Yes
16	17 %	No
8	9 %	No response
92	100 %	

Members who have the 4th edition

Number	Percentage	
45	49 %	Yes
38	41 %	No
9	10 %	No response
92	100 %	

IA Documents in Use

- RP-1 51 %
- None 17 %
- Manufacturer spec. 11 %
- Other sources 21 %
  - ILAC, ASTM, GMP, OIML, GLP 10 %
  - Internal (military, NASA) 7 %
  - Customer, legislation 4 %

General Policies

Policy	Yes	No
– Assign intervals	63 %	37 %
– Delay date (36 % unk.)	14 %	50 %
– Use mfr. tolerances	38 %	62 %

- Assigned intervals: 1 d to 20 yr
- Most common (62 %): 1 year
- Most common unit (51 %): months

Instrument Adjustment Policy

- Adjust
  - If out of tolerance 39 %
  - At technician's discretion 21 %
  - If outside a guardband 19 %
  - Special rules 11 %
  - Never 7 %
  - Always 3 %

Inventory Composition

- Workloads: up to 750,000 cals/yr
- Serial numbers per model: 1 to 8,000
- Equipment Life
  - Extremes: 1 wk to 70 yr
  - 25 % of responses: 1 yr to 30 yr

Records and Data

74 % keep calibration history records, 26 % did not respond

- Data retained
  - Full measurement data
    - Uncertainty 40 %
    - Data only 50 %
  - Pass-fail by
    - Test point 35 %
    - Instrument 34 %
- Kept electronically
  - All data 49 %
  - Measurements 15 %
  - Pass-Fail 15 %
  - Some, unk. 12 %
  - None 9 %

Reliability Monitoring

- Monitor reliability by
  - Serial number 38 %
  - Make-model 25 %
  - Instrument type 27 %
  - Other 10 %
- Analysis driver
  - Periodic review 25 %
  - Continuous 20 %
  - Spec. change 17 %
  - Customer rqst. 15 %
  - Equip. change 14 %
  - Other 8 %

Interval Database

- The RP-1 working group has discussed hosting an interval database and the survey asked about its utility.
- Number Percentage
- 50 54 % Yes
- 42 46 % No
- 0 0 % No response
- 92 100 %

Contribution to interval database

- The survey also asked who would supply data to such a database.
- Number Percentage
- 29 32 % Yes
- 63 68 % No
- 0 0 % No response
- 92 100 %

Software and Training

- Software
  - None 31 %
  - Custom 29 %
  - Commercial 12 %
  - LMS with IA 12 %
  - Freeware 8 %
- Personnel Trained
  - Zero 36 %
  - 1 to 2 30 %
  - 3 to 5 27 %
  - 10 to 20 11 %
  - 50 to 70 6 %

Five general methods addressed

- The General Interval
- The Borrowed Interval
- Engineering analysis
- Reactive methods (three—A1, A2, and A3)
- Statistical (MLE Maximum Likelihood Estimation) methods: three—S1, S2, S3

Initial-Interval Method Use

Number	Percentage	
36	29 %	By like items
33	26 %	Borrowed
21	17 %	Engineering analysis
14	11 %	Per calibration vendor
12	10 %	Mfr, regs, industry, etc.
10	8 %	General (1 size fits all)
126	100 %	

Adjustment Method Use

Number	Percentage	
33	28 %	Method A1
14	12 %	Method A2
23	20 %	Method A3
13	11 %	Method S1
12	10 %	Method S2
10	9 %	Method S3
12	10 %	Other
117	100 %	

Reliability Target Choice

- How to choose?
  - Unclear 38 %
  - Internal formula 20 %
  - Use, risk, spec 19 %
  - Ind. Standard 10 %
  - 2 % PFA 8 %
  - Mandated 5 %
- Target chosen
  - None, unclear 35 %
  - 95 % 27 %
  - Variable 10 %
  - 90 % 8 %
  - ≤ 85 % 8 %
  - > 95 % 7 %
  - ≥ 89 % 5 %

Things members liked (1)

- Comprehensive body of expert knowledge
- Good reference & guidance document
- Pros and cons for each method
- Industry vetted
- Addresses a very useful topic
- Offers several options

Things members liked (2)

- Good examples, detail on the methods
- A “go to” document of reference to best practices
- Generally clear and well-written
- Thorough and informative
- Easy to read

Things members disliked

- Nothing (26 %)
- Long, complicated
- Impractical, resource intensive
- Does not fit that member’s requirements
- Does not help Legal Metrology
- Lacks performance evidence

IA Obstacles

- Nothing (24 %)
- Little or no control of intervals
- Customers override
- Legal requirements, industry standards
- Insufficient electronic records
- Resources, time, complexity
- Lack of awareness of the cost benefits

Suggestions

- Lobby to make it an international standard
- Add other published approaches
- Write a “Cliff Notes” edition
- More initial-interval establishment material

Some Take-Aways

- Interest in continued development
  - Variables data methods
  - Quantitative guidance from simulation
  - Monitor delay dating interest
  - Reliability target guidance
- Promotion, education
  - RP awareness, basic concepts
  - Assist standards developers