

THE CALIBRATION LOAD LEVELING FRAMEWORK

Reducing unnecessary equipment touches, downtime, and lifecycle cost while maintaining measurement assurance

By Sean Gonnoud
CHA Consulting, Inc.

Executive Summary

Calibration programs are designed to provide confidence that instruments remain capable of producing accurate and reliable measurements. In regulated manufacturing, this function is essential to product quality, process control, patient safety, and inspection readiness. Yet the operational impact of calibration is frequently evaluated only through technician labor or the number of completed work orders. That view can materially understate the true cost.

Every time an instrument or equipment train is accessed, production may be affected. Equipment may need to be placed in a safe state, process access may need to be coordinated, operations may need to provide support, quality may need to review documentation, and the equipment may require startup or verification after the work. When related activities are scheduled independently, the same asset can be touched multiple times during a year.

Calibration Load Leveling addresses this problem by treating calibration as part of an integrated production, maintenance, and asset-management strategy. The framework balances workload, aligns calibration with planned outages, groups work by location and process, promotes instrumentation standardization, and proactively addresses obsolete assets.

The central operating principle is the One Touch, One Downtime methodology.

This methodology is based on the approach of using, whenever practical, a single planned intervention to complete all compatible calibration, inspection, preventive maintenance, verification, and asset-management activities The objective is not to perform fewer calibrations. It is to achieve the required level of measurement assurance with less unnecessary operational disruption.

KEY TAKEAWAYS:

Reduce the number of times an instrument or equipment train must be accessed.

Align calibration work with existing production and maintenance windows.

Level workload to reduce peaks, overtime, and contractor dependency.

Use standard instrumentation to reduce training, spares, and calibration complexity.

Treat obsolescence as a planned lifecycle risk rather than an emergency replacement problem.

Measure financial value using avoided downtime, reduced touches, labor efficiency, and lifecycle cost.

1. Industry Data & Benchmarking

The need for calibration is well established across regulated and precision-driven industries, as well as applications where low measurement uncertainty, precision, and accuracy are critical throughout every phase of the product life cycle. However, there is no single, universally accepted benchmark that defines how often each instrument should be calibrated or how many technician-hours a site should require. While NIST, ILAC, OEM, and ISO guidance provide important frameworks, they do not prescribe a one-size-fits-all approach. This supports a data-driven approach rather than automatically treating every asset as an identical annual event.

From an operational perspective, benchmarking should focus on the performance of the entire calibration system. A site should establish a baseline before implementing optimization and then compare results over time. Useful benchmarks include workload distribution, instrument touches, downtime events, compliance, technician utilization, overtime, contractor spend, and obsolete critical assets.

ILLUSTRATIVE MANAGEMENT TARGETS ARE SHOWN BELOW:

These are not regulatory requirements and should be customized to the site.

Metric	Illustrative Baseline	Potential Target
Monthly workload variance	±30–40%	±10–15%
Instrument touches / asset / year	4.0–5.0	2.0–3.0
Planned calibration outages	Baseline	20–40% reduction
Critical calibration compliance	≥99%	≥99.5%
Technician's productive utilization	60–75%	80–90%
Critical obsolete assets	Baseline	Zero unmanaged critical assets

The value of benchmarking is not the target itself. The value comes from establishing a repeatable measurement system that demonstrates whether optimization is actually improving site performance.

2. The Hidden Cost of Instrument Touch Time

Touch time should be defined broadly. It includes any event that requires personnel to access, isolate, manipulate, test, adjust, document, or return an instrument or equipment package to service. A calibration work order may report only the technician's hands-on time, while the organization experiences a much larger operational event.



COMPONENTS OF TOUCH COST:

Technician labor: setup, testing, adjustment, documentation, and closeout.

Operations support: equipment access, process isolation, startup, and operator assistance.

Quality support: review, approval, deviation assessment, or record review.

Maintenance/Engineering support: access, controls, utilities, troubleshooting, or equipment preparation.

Health and Safety support: JSA, hot work and other permitting requirements.

Mobilization: travel between areas, staging, tooling, and setup.

Downtime: production capacity unavailable while the equipment is out of service.

Restart and verification: returning the equipment to a qualified operating condition.

COST-OF-TOUCH-TIME FORMULA

Total Touch Cost = Direct Labor + Operations/QA Support + Mobilization + Equipment Preparation + Downtime + Restart/Verification.

For example, assume a pressure transmitter requires 30 minutes of calibration but causes a two-hour equipment interruption. If the process has an approved downtime value of $1,500 per hour, the downtime component alone is $3,000. The technician's labor may be comparatively small. This is why load leveling should be evaluated as an operational strategy, not simply a labor-efficiency initiative.

TOUCH REDUCTION OPPORTUNITY:

A practical improvement is to compare the number of annual touches with the number of planned interventions. If five separate work orders require five separate equipment access events on the same piece of equipment, there may be an opportunity to consolidate those activities into one coordinated outage. The analysis should distinguish truly independent tasks from activities that can safely and compliantly be performed together.

3. Calibration Load Leveling

The framework consists of ten connected steps. Each step reduces a different source of inefficiency while preserving calibration quality and regulatory control.

01. **Asset Inventory & Data Quality**
Create a reliable population of instruments, equipment, locations, criticality, calibration frequency, work duration, responsible discipline, and current due dates. Poor master data creates poor scheduling decisions.

02. **Criticality Classification**
Rank assets according to product quality, process control, patient or customer impact, safety, environmental impact, and business continuity. Criticality helps determine where optimization can and cannot be aggressive.

03. **Workload Mapping**
Map annual demand by month, week, building, process, discipline, technician skill, and expected duration. Heat maps can identify predictable workload peaks.

04. **Production Alignment**
Overlay calibration requirements against production campaigns, planned maintenance, shutdowns, changeovers, cleaning windows, and other periods when equipment is already expected to be unavailable.

05. **Work Grouping**
Group compatible work by room, skid, production line, utility system, building, equipment train, and discipline. The objective is to minimize mobilization and repeated access.

06. **Due-Date Optimization**
Where scientifically and procedurally justified, redistribute work using approved change control, risk assessment, historical performance, and applicable requirements. Optimization must never be used to conceal overdue work.

07. **Workload Balancing**
Move feasible work away from peak periods into available capacity while maintaining compliance and operational priorities. The goal is a predictable workload rather than an artificially equal number of work orders.

08. **Standardization**
Reduce unnecessary variation in instrument families, ranges, procedures, test points, and calibration equipment where engineering and quality requirements permit.

09. **Obsolescence Management**
Identify unsupported or end-of-life assets before failure. Prioritize replacement using criticality, failure history, spare availability, support status, and lead time.

10. **Continuous Improvement**
Review touch index, downtime, compliance, OOT trends, utilization, cost, and obsolete assets quarterly. Use results to refine the next planning cycle.

4. One Touch, One Downtime Methodology

One Touch, One Downtime is the execution philosophy within the broader framework. When a process, skid, room, or equipment train must already be taken out of service, the planning team asks a simple question:

What other compatible activities can be completed during the same intervention?

POTENTIAL COMBINATIONS:

- CALIBRATION
- INSPECTION
- FIRMWARE / CONFIGURATION VERIFICATION
- LOOP CHECKS / FUNCTIONAL CHECKS
- PREVENTIVE MAINTENANCE
- BATTERY REPLACEMENT
- LABELING
- ASSET DATA VERIFICATION

The method should be applied through a formal work-package process so that each activity has defined ownership, prerequisites, acceptance criteria, and documentation.

USE CASE:

Current state:
A production skid has a pressure transmitter calibrated in January, a temperature transmitter calibrated in March, and a flow instrument calibrated in June. Each event requires equipment access and operations support.

Optimized state:
The site identifies a planned June shutdown, confirms that the January and March activities can be brought into the approved window, and performs all three activities during one coordinated intervention. The result is one equipment access event instead of three, subject to applicable requirements and approved planning.

GUARDRAILS:

Do not extend equipment downtime merely to increase the number of work orders completed.

Use formal change control when due dates or established intervals are changed.

Maintain complete traceability and required calibration records.

Prioritize critical assets and production constraints appropriately.

5. Standardization of Instrumentation

Instrumentation standardization is a major enabler of load leveling because a standardized asset population is easier to calibrate, troubleshoot, stock, train technicians on, and replace. A site with many instrument families may require different calibration standards, procedures, software, cables, adapters, spare parts, and technician competencies.

STANDARDIZATION STRATEGY ELEMENTS:

01. Establish preferred instrument families by application.

02. Define approved ranges and accuracy classes.

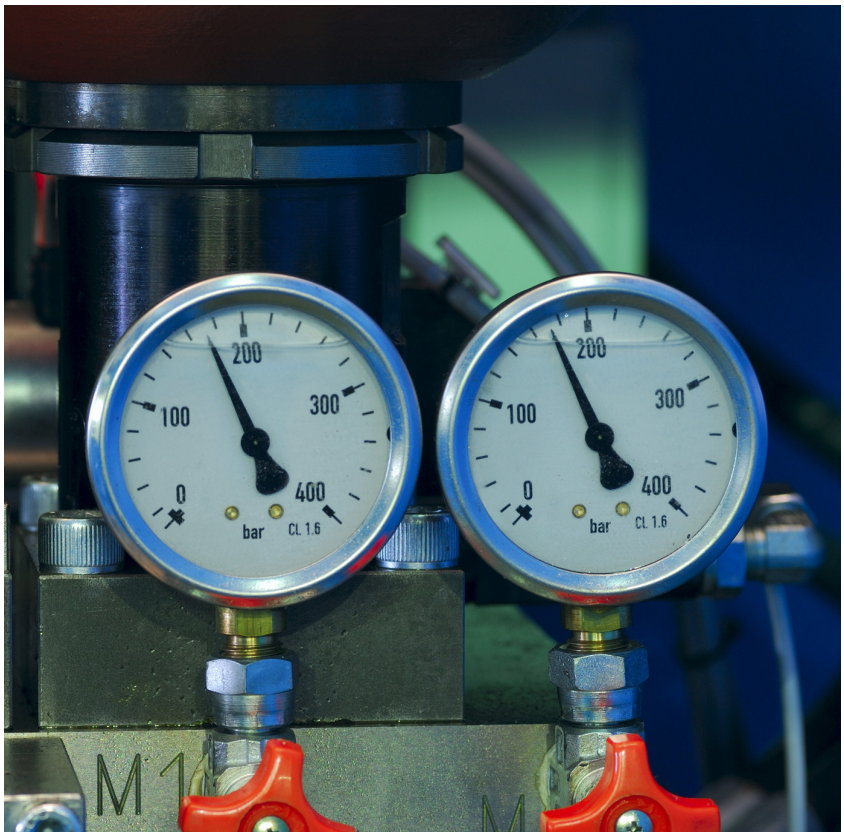
03. Standardize outputs and communication protocols where practical.

04. Standardize mounting, connections, and accessories where engineering allows.

05. Develop common calibration procedures and test-point strategies.

06. Maintain an approved spare and replacement strategy.

07. Use deviation or engineering review where standardization is not appropriate.



The goal is not uniformity for its own sake.

The goal is to reduce unnecessary variation where engineering and quality requirements permit.

6. Instrument Obsolescence & Its Impact

Obsolescence is often discovered only after an instrument fails or a replacement is urgently needed. This creates avoidable downtime and can create compliance risk when an organization struggles to maintain the required measurement capability.

INDICATORS OF OBSOLESCENCE:

01. Manufacturer end-of-life or end-of-support.

02. Unavailable replacement parts.

03. Unsupported software or communication protocols.

04. Loss of qualified calibration capability.

05. Increasing repair frequency or drift.

06. Long procurement lead times.

07. Limited spare inventory.

08. Dependence on obsolete proprietary components.

09. Increasing total cost of ownership.

OBSOLESCENCE RISK MODEL

Each critical asset should have an obsolescence status such as current, aging, end-of-life announced, unsupported, or replacement required. Combine that status with criticality, failure history, lead time, spare availability, and production impact to create a prioritized replacement list.

The greatest opportunity is to replace obsolete instruments during already-planned shutdowns. This converts an emergency replacement into a scheduled lifecycle activity and can eliminate future calibration and maintenance touch time.



7. Executive KPI Scorecard

Benchmarking is most useful when it establishes a repeatable measurement system that shows whether optimization is improving site performance.

KPI	Definition	Management Objective
Instrument Touch Index	Touches per asset per year	Reduce unnecessary touches
Downtime Consolidation Ratio	Outages consolidated through coordinated planning	Increase
Calibration Efficiency Score	Composite of compliance, workload, and utilization	Increase
Critical compliance	On-time completion of critical calibrations	Maintain ≥ site requirement
Avoided downtime hours	Estimated hours eliminated through consolidation	Increase
Obsolete critical assets	Critical assets requiring lifecycle action	Reduce
Monthly workload variance	Actual demand vs balanced plan	Reduce variance
Overtime/contractor hours	External or premium labor used	Reduce where practical

8. Implementation Roadmap

THIS FIVE-PHASE ROADMAP GUIDES IMPLEMENTATION:

01. **BASELINE**
Collect asset, workload, downtime, labor, criticality, and obsolescence data. Establish current KPIs.

02. **PILOT**
Select one production area with meaningful calibration volume and planned shutdown activity. Apply the framework for one cycle.

03. **VALIDATE**
Compare touches, downtime, compliance, labor, and stakeholder feedback against baseline

04. **EXPAND**
Roll out to additional areas and integrate with maintenance and production planning.

05. **SUSTAIN**
Establish quarterly governance, annual workload leveling, standardization reviews, and an obsolescence program.

9. Conclusion

Calibration should support production rather than unnecessarily interrupt it. The Calibration Load Leveling Framework described here combines workload balancing, production alignment, the One Touch, One Downtime approach instrumentation standardization, lifecycle management, and financial measurement into a single operating strategy.

The objective is not simply fewer calibration work orders. The objective is to have fewer unnecessary equipment interruptions while maintaining the required level of measurement assurance. When implemented with appropriate quality, engineering, maintenance, and operations controls, this approach can improve asset availability, reduce lifecycle cost, increase technician effectiveness, and provide a measurable business case for calibration optimization.

ABOUT THE AUTHOR:



Sean Gonnoud

Section Manager and Senior Metrologist in the Advanced Technology-Asset Management Services Group at CHA Consulting, Inc. (CHA). Sean has 15 years of experience in pharmaceutical calibration, FDA compliance, and Standard Operating Procedure (SOP) development. He has consistently served as the key contact for various pharmaceutical companies, handling matters related to identifying, rectifying, and calibrating multiple instruments, strictly adhering to applicable rules and regulations.

You can reach Sean at sgonnoud@chasolutions.com

FOR PROJECT SUPPORT, CONTACT:



Dan Kepfer

Managing Director of Advanced Technology – Asset Management Services at CHA Consulting, Inc. (CHA). Dan has more than 20 years of experience in streamlining processes and procedures to improve efficiency and reduce costs. He excels in providing strategic approaches and sustainable solutions to complex projects, with expertise in analyzing and evaluating information to identify deficiencies and recommend appropriate solutions.

You can reach Dan at dkepfer@chasolutions.com