

17th NATIONAL CONFERENCE ON BUILDING COMMISSIONING

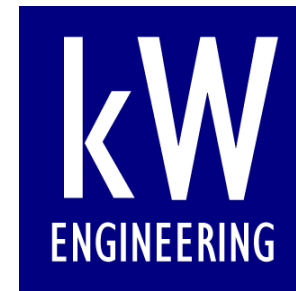


EFFICIENCY • PERSISTENCE • PERFORMANCE

Prioritizing Persistence:

Approaches and Technologies that
Enable Lasting Results

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AIA Quality Assurance



Learning Objectives

- 1. Learn practical tips to improve the persistence of RCx efforts**
- 2. Learn an overall perspective on the RCx process which actively considers the future and not just today's results**

My background

Peter Pollard, P.Eng. MBA

- 18 years in manufacturing industries
 - building and maintaining plant and equipment expansions and improvements
- 4 years in energy efficiency, leading over 100 RCx and audit projects
 - Many of my insights into achieving persistence of energy savings draw from experience with:
 - **industrial maintenance** best practices
 - **technology transfer** techniques applied when creating and optimizing manufacturing equipment and processes

Preface

General thoughts up front

- Persistence of commissioning efficiency means successful maintenance
- Engineers don't and can't know everything
- Teamwork with staff and techs is essential
- Build respect between engineers and tradespeople

Topics

1. Management and Culture
2. Documentation
3. Measurements and Alarms
4. Training
5. Maintainability



1. MANAGEMENT AND CULTURE

Persistence requires an effective maintenance culture

Four corners must support it -

- Managers
- Team Members
- Teamwork
- Champions



Managers

Convince management that achieving persistence is important

- Money \$
- Carbon footprint CO₂
- Team motivation
- Comfort

Which are going to make them successful?

Managers

Don't leave
managers in the
fog



Team Members

Need maintenance team members excited (again?) about having things working right

- Listening
- Providing feedback on results
- Advertising successes
 - On a bulletin board, in a newsletter, with special team buttons or shirts or hats. An email to the boss. Plaques. Something to show their kids.
- Listening

Teamwork

Making teamwork work

- The right kinds of :
 - Meetings
 - Attitudes
 - Milestones
 - Info sharing
 - Education



Teamwork

RCx project work must be:

- Inclusive
- Supported
- Problem-focused
- Steered by clear goals
- Budgeted



Champions

Need staff who are ready to set the example

- Identify
- Encourage and empower
- Recognize and reward
 - Reward high performance
- Provide resources
 - Provide budget or quick access to budget
 - Free up their time



2. DOCUMENTATION

Good documentation is NOT just big binders on a shelf.

Documentation should be:

- Readily available
- Understandable by the staff
- Useful to technicians who may be new and untrained

Documentation

Equipment info and labeling

- Right there, not in the managers office



Documentation

Pipe Labeling

- Even if it's obvious to you



Documentation

Go lamacoid crazy

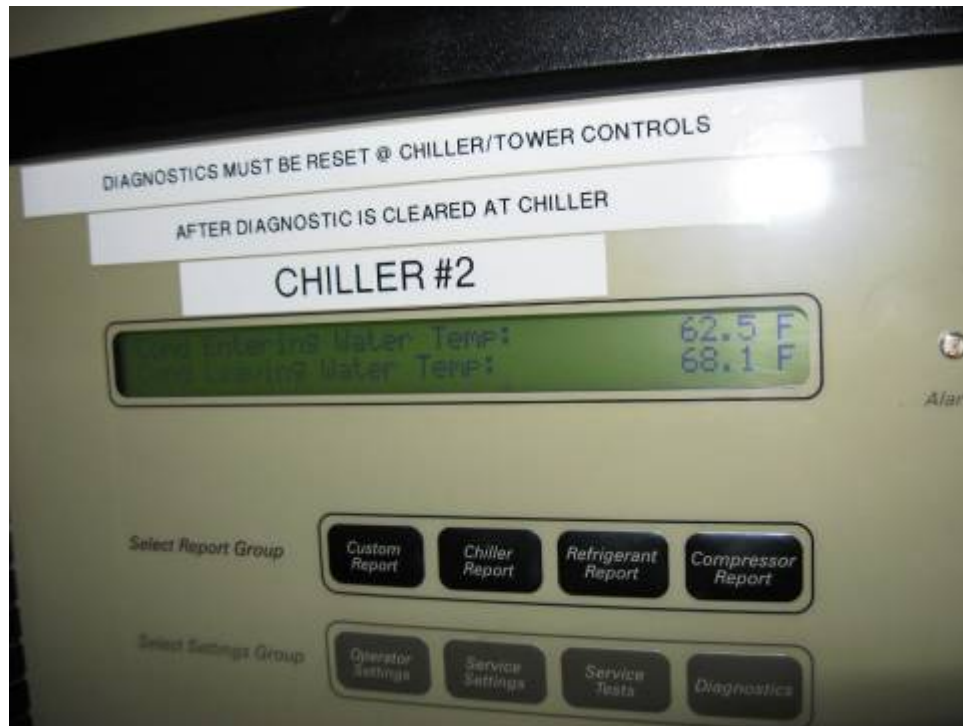
- Permanent equipment labeling
- Lamacoids (engraved nameplates) are durable, and more trusted than hand-scribbles
- Not just for electrical !



Documentation

Label makers will do, I suppose

- Not as permanent or trusted as lamacoids



Documentation

Laminated how-to's on equipment

- Again, right there and accessible
- Can be studied without anyone watching

Documentation

Not bad



Documentation

Benchmark photos

- What *should* it look like?
 - Eg. process equipment

3. MEASUREMENTS AND ALARMS

Must quickly show the right trends to the right people

- Rarely done well
- Different data to different people
- Generating the data itself is only step 1
- Data needs to be **communicated**

Communicating Measurements

Communication of data

- USING data means **sorting and summarizing** often vast quantities of data into what's important
- Data needs **benchmarks and references** to indicate when things aren't what they should be

Communicating Measurements

Communication of data

- Not complicated
- But it does need real effort and budget upfront

Communicating Measurements

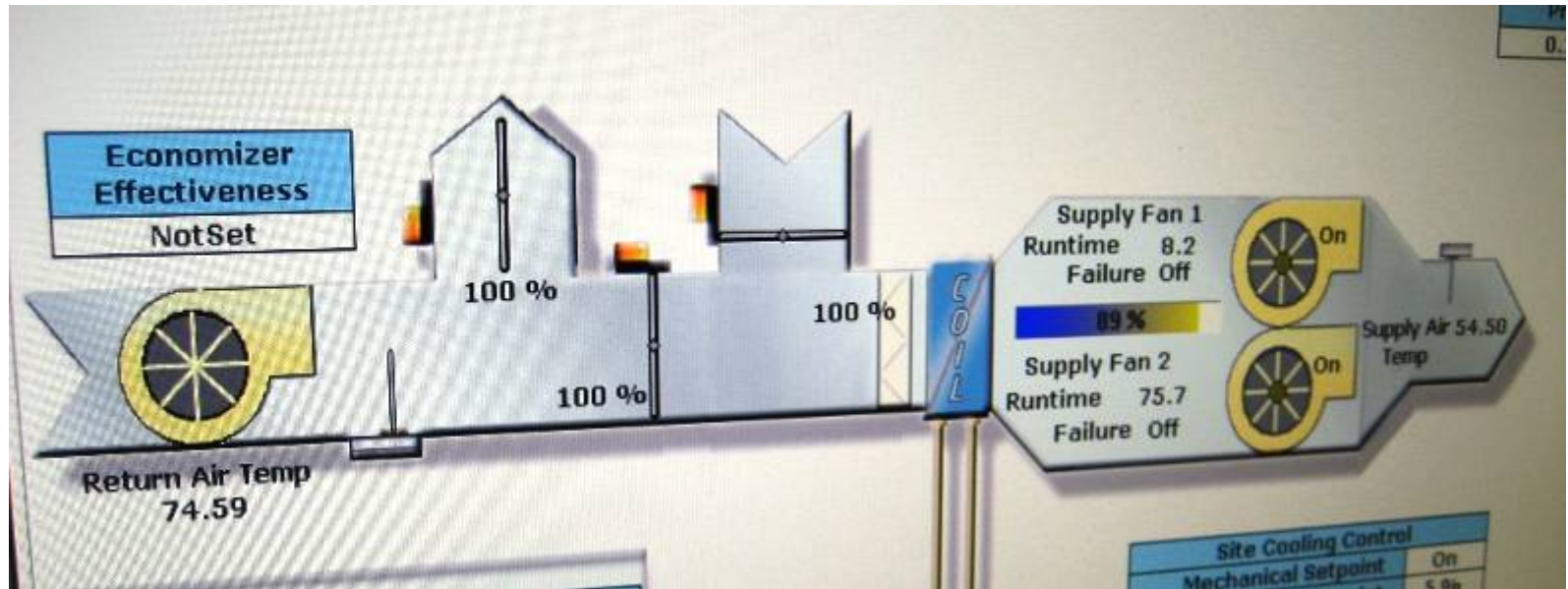
The power of good graphics

- Where are the warm rooms?



Communicating Measurements

...if done right



Communicating Measurements

Front End Upgrade

- Recommend it
- IBS example >
 - Dashboards
 - Custom reports
 - Key trends

www.ibs-cal.com



Communicating Measurements

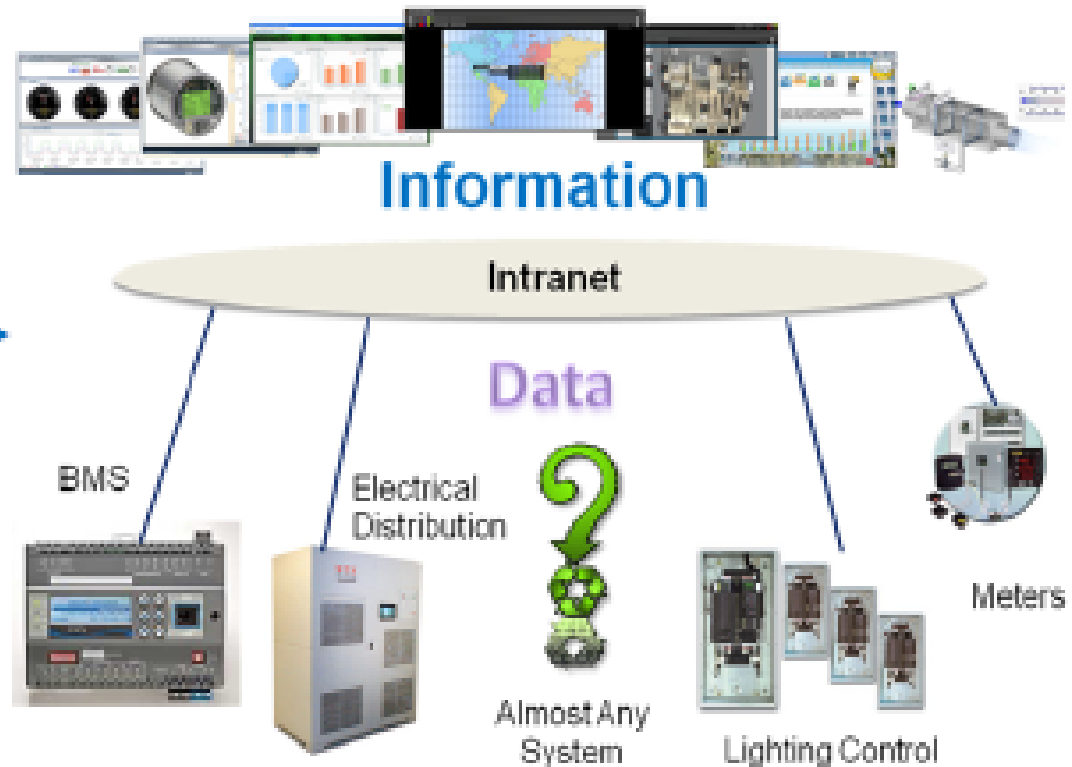
Example

The IBIS Way

One Web Based, Enterprise Level Graphical User Interface with user defined reporting tools.



- Automated reports
- Alerts and alarms
- Multiple users
- Full system visualization.



Communicating Measurements

Example



Efficiency



Comfort

www.dcsenergy.com



Communicating Measurements

Example

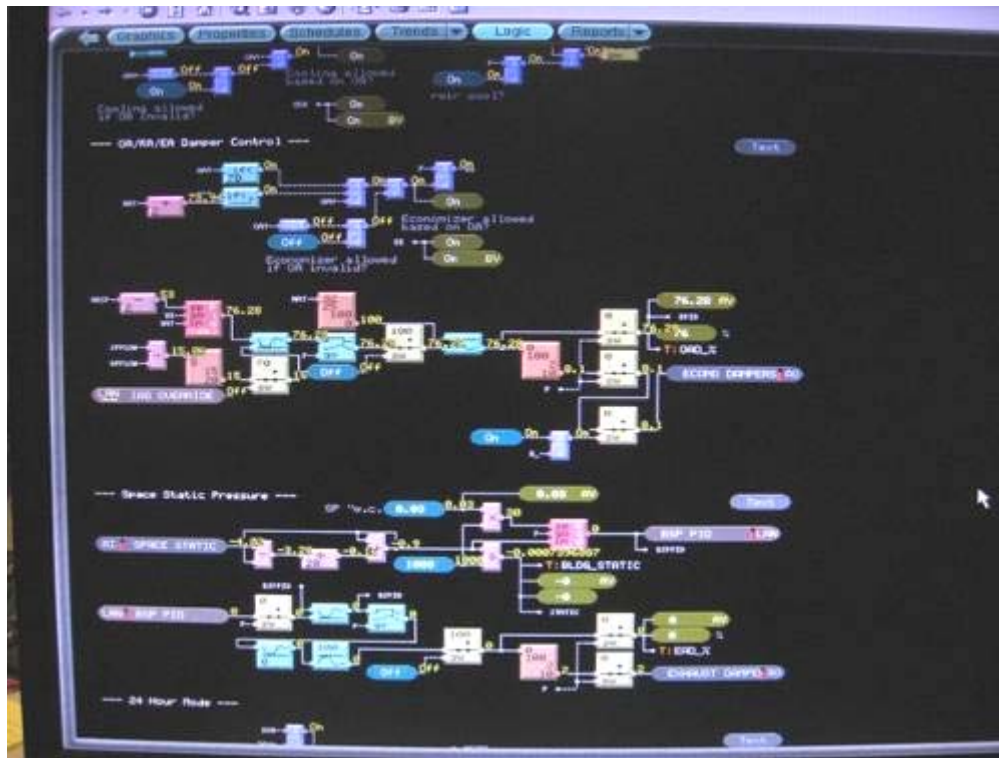


www.millennial.net
- wireless mesh
networking, including
power monitoring

Alarms

Much opportunity for better alarm functions

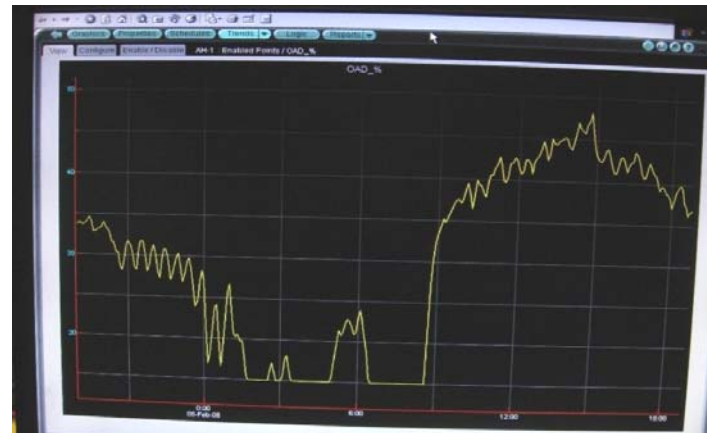
- Takes work upfront



Alarming Example

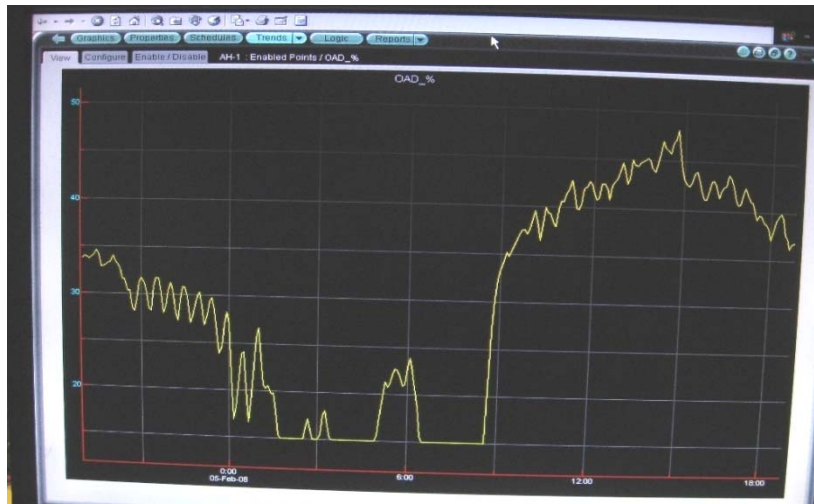
Eg: Economizer alarm algorithms

- OA damper position (%OA) is often shown and even trended
- But this is what the control wants, NOT necessarily what it gets



Alarming Example

Economizer controls vs. reality



Alarming Example

A refreshing cold air blast ?

- OAT = 88°F
- RAT = 73°F
- MAT = 88°F
 - Clearly wrong on the roof
 - But invisible on the BAS



Alarming Example

Economizer alarms

- Set alarm if:

- $\text{MAT} > [\text{OAT} + 3^\circ\text{F}]$,

- when $\text{OAT} < \text{RAT}$ and cooling

< Cool conditions,
not enough OA

- $\text{MAT} > [\text{RAT} + x^\circ\text{F}]$,

- when $\text{OAT} > \text{RAT}$,
 - where x reflects minimum outside air requirement; typically $x = 5^\circ\text{F}$

< Hot conditions,
too much OA

Alarming Example

Economizer alarms - inputs

- Need mixed, outside and return air temperature sensors on each system;
- Supply air temperature too, or another way to indicate cooling (eg. cooling requests).
- Mixed air sensor location especially important (generally true for good economizer control)

4. TRAINING

Need to:

- Get staff buy-in to the importance of persistence
- Decide on the content that matters

Training

Translate engineer-speak into technician-speak

- Cut back on theory
- Include practical techniques for identifying issues
- Keep it engaging by staying practical and relevant on the ground

Training

Not the desired attitude:



5. MAINTAINABILITY

Making things easy to maintain

- Transparent controls
- Simple control sequences
- Accessible equipment

Controls

Transparency of controls

- Comments and documentation in the programming itself is generally poor
- Technicians often cannot decipher without significant training
- Intent of programming should be documented, preferably in the program itself

Controls

Control sequences -

KISS: Keep it simple, stupid.

- Control strategies that staff can understand, optimize and troubleshoot
- Simpler strategies can achieve 90% of savings today with a higher chance of persisting in the future
- Simple strategies can also be cheaper upfront to implement

Example 1

KISS: Simple Static Pressure Reset

- Static pressure reset that varies based on one or two simple inputs
 - eg. outside air temperature, solar load sensor, and/or the thermostat in boss's corner window office; or occupancy schedule
- Outputs: high or low
 - Eg. 1.5 "wc or 1.0 "wc
- Simple, conservative, understandable, cheap approach (no DDC)

Example 2

KISS: Simple Pump Control

- Eg. 4 pumps, 3 chillers
- Base case: 4 pumps always on
- Measure: Add VFDs and control pumps
 - Option 1: Stage and control 4 pump VFDs to maintain exact flow (complex)
 - Option 2: Stage pumps on with chillers (simple)

Access

Accessible equipment

- Not this



Access

Can humans easily get around?

- Crowded rooftops and central plants



Access

Can humans easily get around?

- Encourage sites to add access platforms, stairs (vs. ladders), adequate lighting
- Added costs can usually be carried by RCx measures which have high savings and low direct costs

Finally

Give 'er your all !



AIA Quality Assurance



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