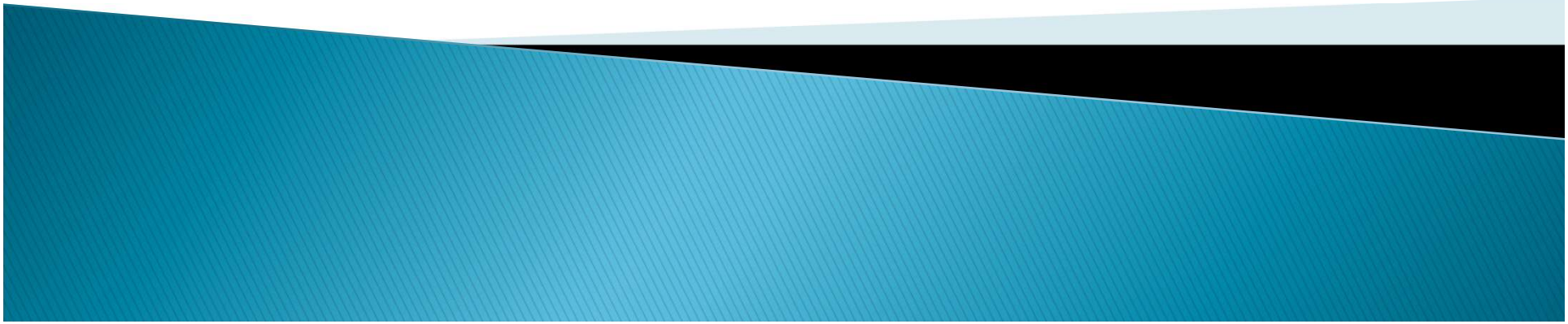
Integration of Online Instrument Data with SCADA and LIMS:

Problems and Concerns with Meeting the Requirements for Regulatory Reporting

Part 1



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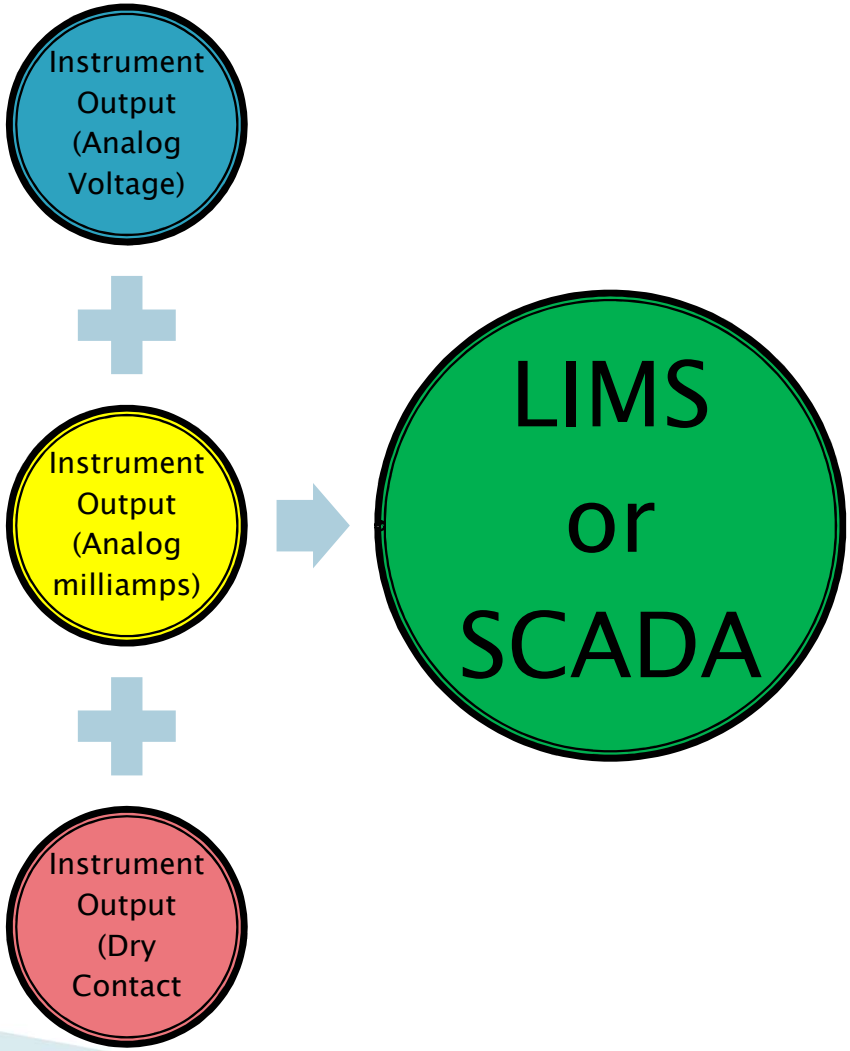
- Required for the Use of Online Data for Regulatory Reporting

1. Demonstration of Capability (DOC),
2. **Method Detection Limit (MDL),**
3. Reagent blank (also referred to as method blank),
4. Laboratory fortified blank (LFB, also referred to as a spiked blank, or laboratory control sample (LCS)),
5. Matrix spike (MS), matrix spike duplicate (MSD), or laboratory fortified blank duplicate (LFBD) for suspected difficult matrices,
6. Internal standard/s, surrogate standard/s (for organic analysis) or tracer (for radiochemistry),
7. Calibration (initial and continuing),
8. Control charts (or other trend analyses of quality control results), and
9. Corrective action (root cause analyses),
10. Specific frequency of QC checks,
11. QC acceptance criteria, and
12. Definitions of a batch (preparation and analytical)

Getting the System to Work

- How do you get a signal and what do you do with it?

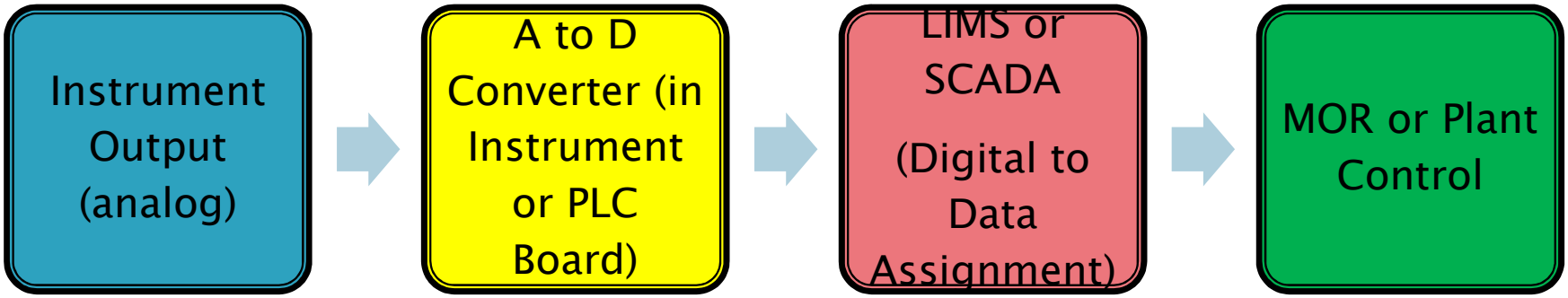
What Happens in the Plant



Online Instrument Output

What Is It and What Do You Use It For?

What Happens in the Plant



Dry Contact Closure

- Turn process on:
  - Take Sample
  - Open Gate
  - Turn Pump On
- Turn Process Off
  - Close Gate
  - Turn Off Pump
- *Example: pH has exceeded discharge limit. Turn off outfall pump or close influent gate valve.*

Voltage (+5 or -5 Volts DC)

- Provide start or stop voltage for a PLC or External Controller.
  - Turn pump on or off
  - Turn on sampler
  - Turn recorder on or off
- *Example: Voltage Input to an ISCO®2108 Analog Converter from an Isco Flowmeter is converted into Digital Flow.*

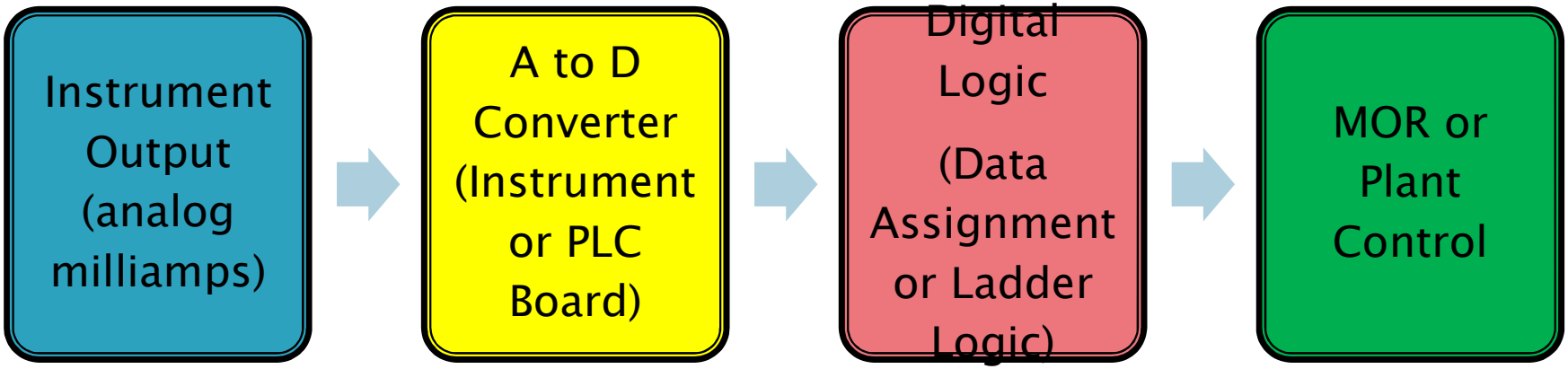
Milliamp A to D

- How do you get a signal and what do you do with it?

Analog to Digital Converter (AtoD)

- Converts analog data in steps to a Digital Signal
- Steps are determined by instrument or by the Programmable Logic Controller (PLC) programmer
  - PLC programmer is only interested in getting the instrument to talk to the SCADA or LIMS!!
  - Instrument is only interested in talking to its control module not the LIMS or SCADA

What Happens with Milliamps



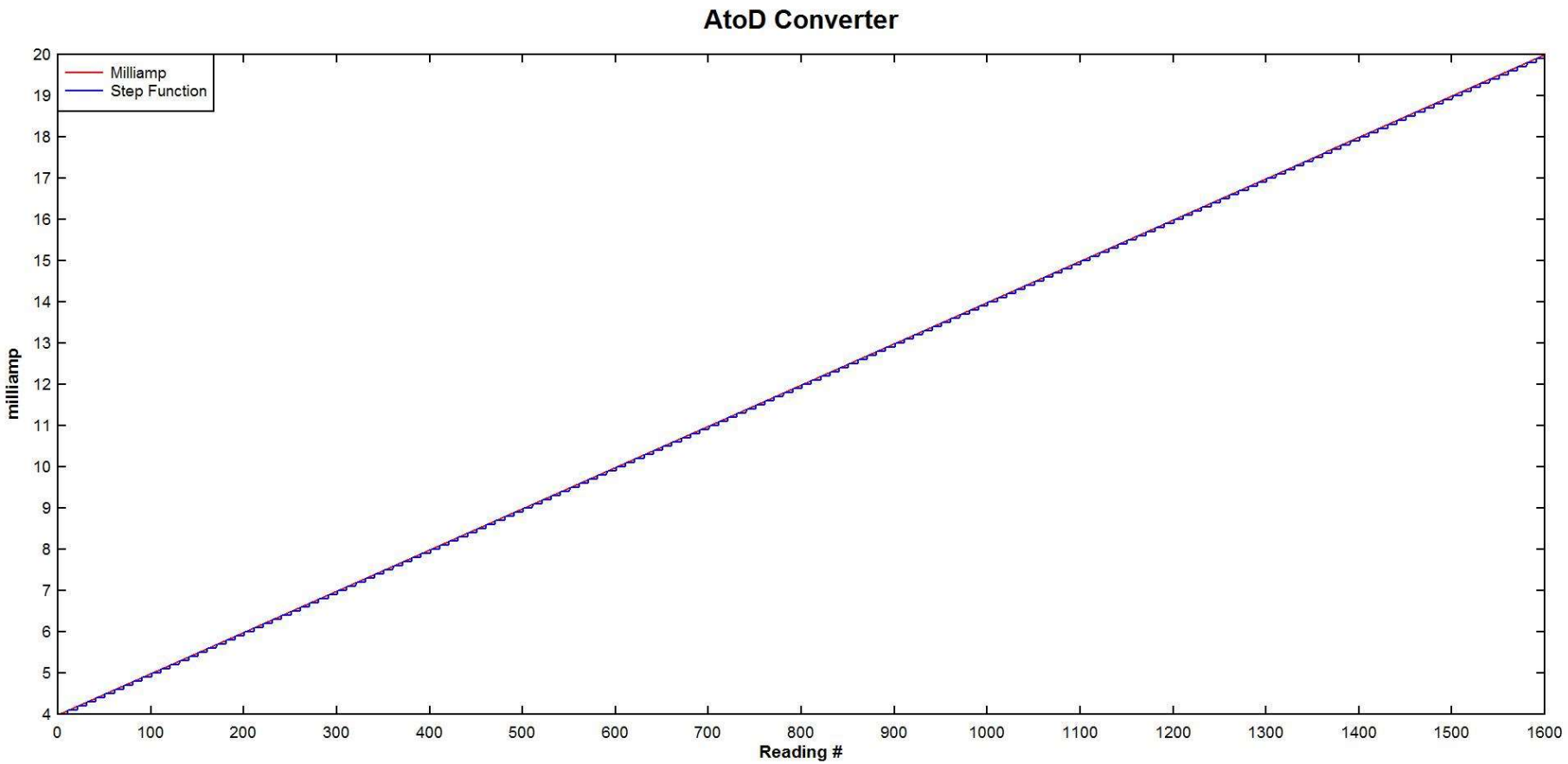
Conversion of Data

- A to D Step Functions

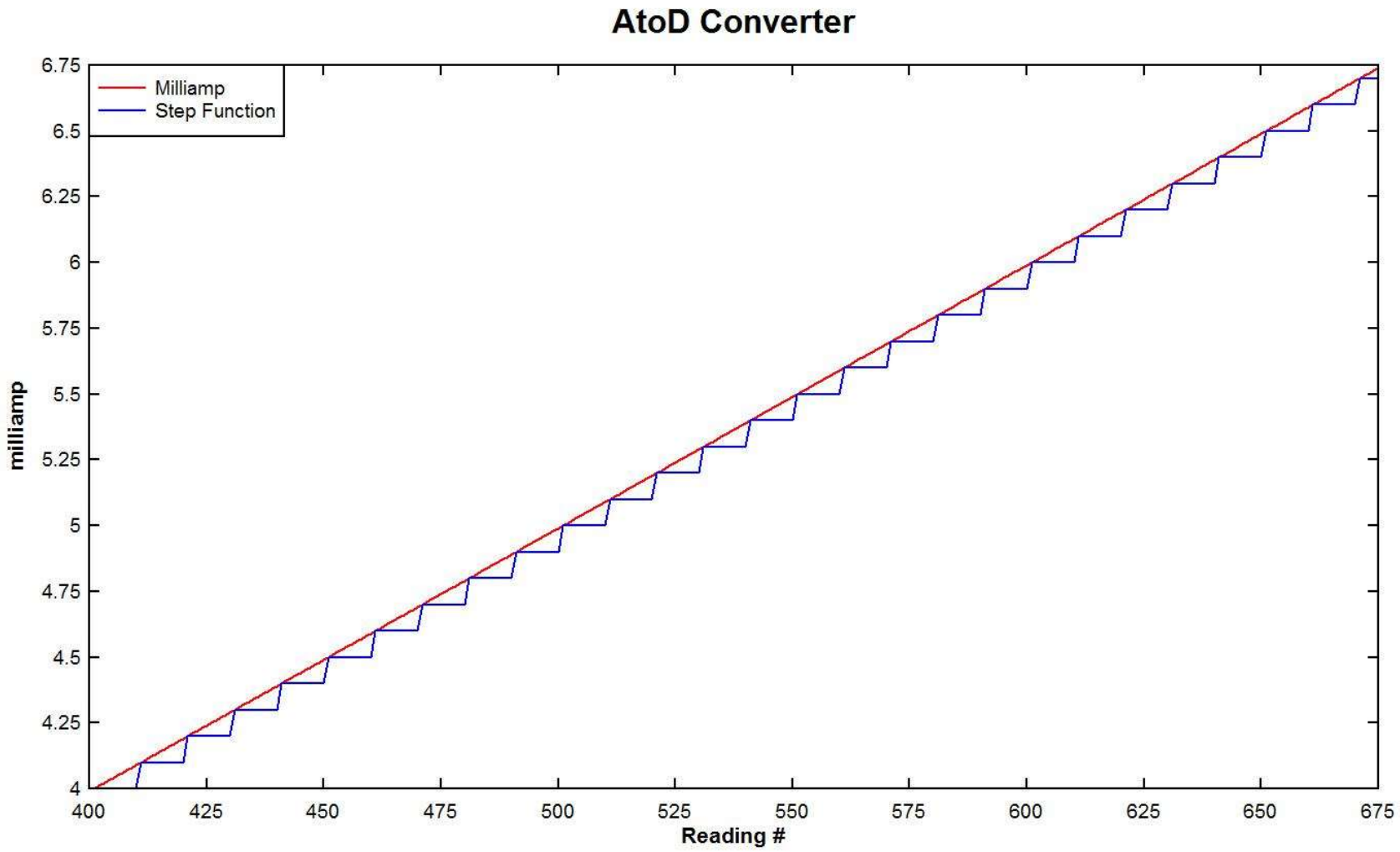
PLC AtoD Conversion

- Range given by Online Instrument (pH Meter)
- Range 4- 20 mAmps
- Digital steps selected by PLC programmer for the A to D Converter
  - Steps: 0.1 mA change = 1 Digital Step
  - 160 steps
- Select Start and Finish Point for pH?????

Stepwise Conversion

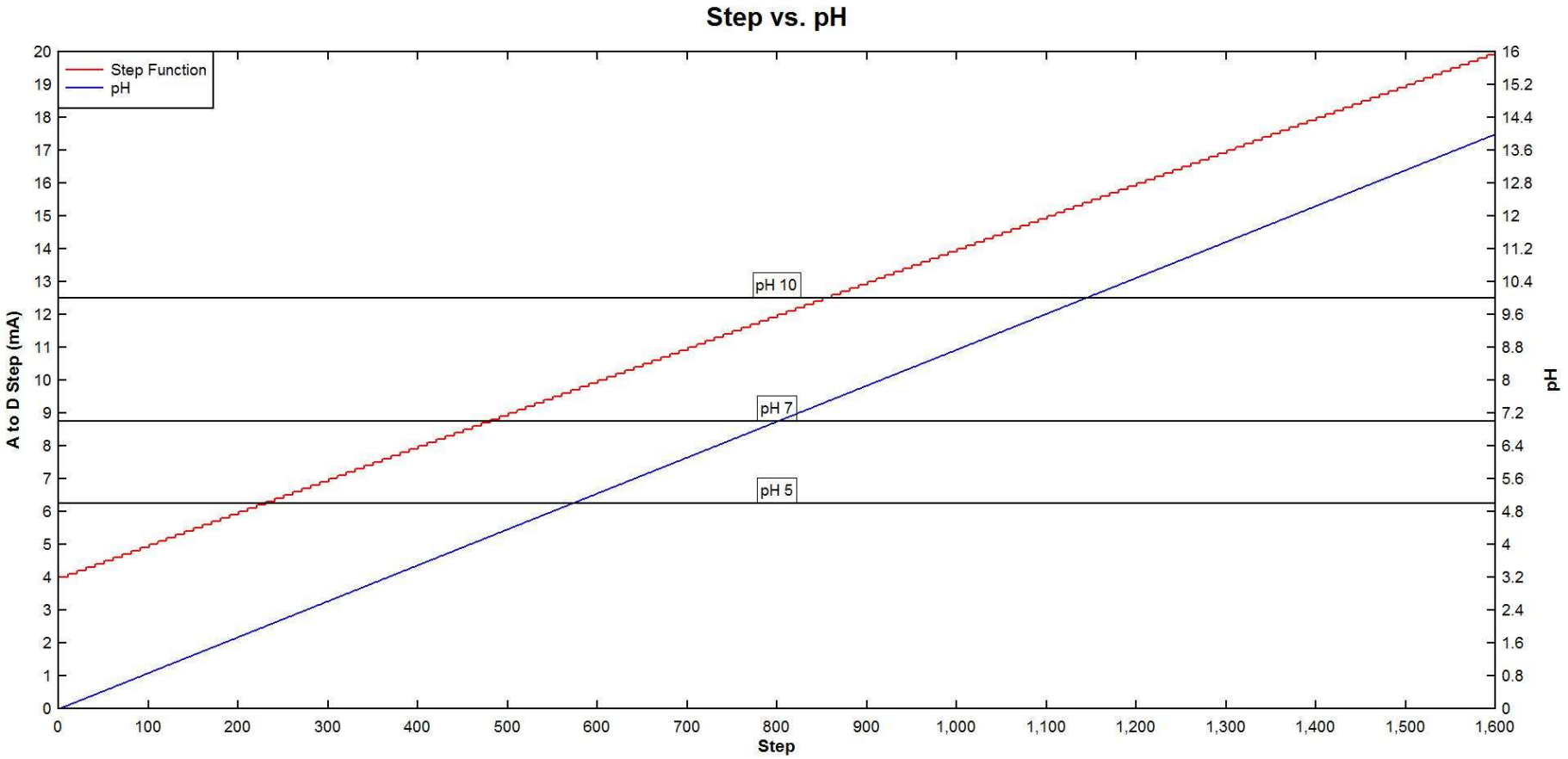


Close-Up


AtoD Converter
Milliamp
Step Function
milliamp
Reading #
6.75
6.5
6.25
6
5.75
5.5
5.25
5
4.75
4.5
4.25
4
400
425
450
475
500
525
550
575
600
625
650
675

Problems

- Example: pH
  - pH is sent to the PLC from the instrument controller as a continuous current.
  - A to D converts the current into 0.1 mA steps
    - More steps may exceed boxcar registers.
    - That means if ANY pH falls within a AtoD step, then the actual pH provided digitally is incorrect.
    - Ladder Boolean logic set on digital steps not analog.
      - Warnings
      - Alarms


Step vs. pH
Step Function
pH
pH 10
pH 7
pH 5
A to D Step (mA)
pH
Step
0
100
200
300
400
500
600
700
800
900
1,000
1,100
1,200
1,300
1,400
1,500
1,600
0
0.8
1.6
2.4
3.2
4
4.8
5.6
6.4
7.2
8
8.8
9.6
10.4
11.2
12
12.8
13.6
14.4
15.2
16
0
1
2
3
4
5
6
7
8
9
10
11
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14
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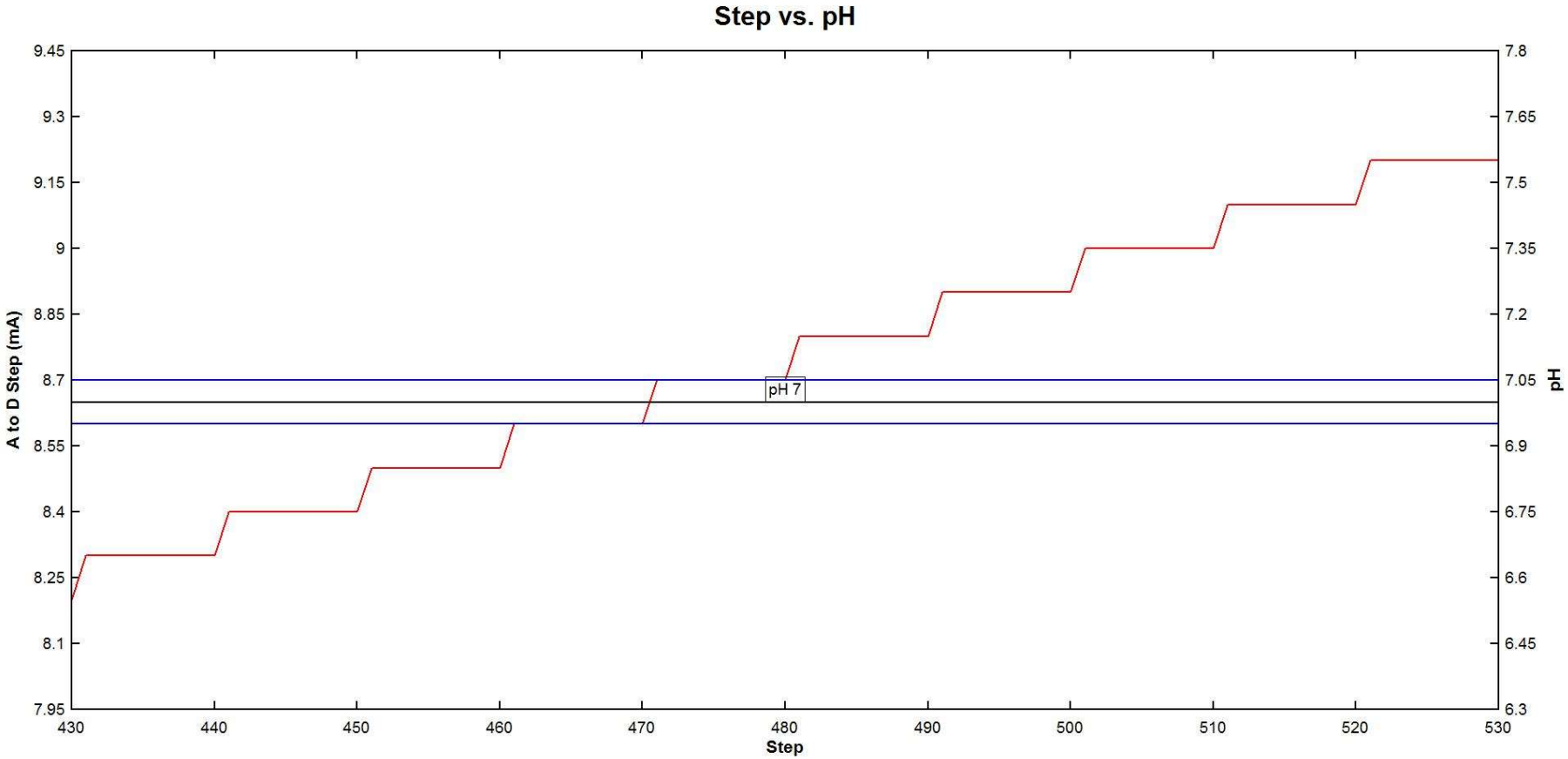
17
18
19
20


Step vs. pH
A to D Step (mA)
pH
Step
pH 7
9.45
9.3
9.15
9
8.85
8.7
8.55
8.4
8.25
8.1
7.95
7.8
7.65
7.5
7.35
7.2
7.05
6.9
6.75
6.6
6.45
6.3
430
440
450
460
470
480
490
500
510
520
530

Questions to Ask

- If You Want to Use This Data for Regulatory Reporting!

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- Can you determine an MDL with the AtoD bias?
- What is your calibration reproducibility if there is current flux with time?
- What is the correct regulatory result with AtoD step bias or Ladder Logic variations that are not specified in the LIMS or SCADA Output?
- For Example:
  - LFB
  - Blank

Part 2

- Thursday: Use of Continuous Monitoring for Possible Uses in Compliance Monitoring

Questions ????