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Data as Simple as Black & White

Nuclear Utility PI Tag Mapping

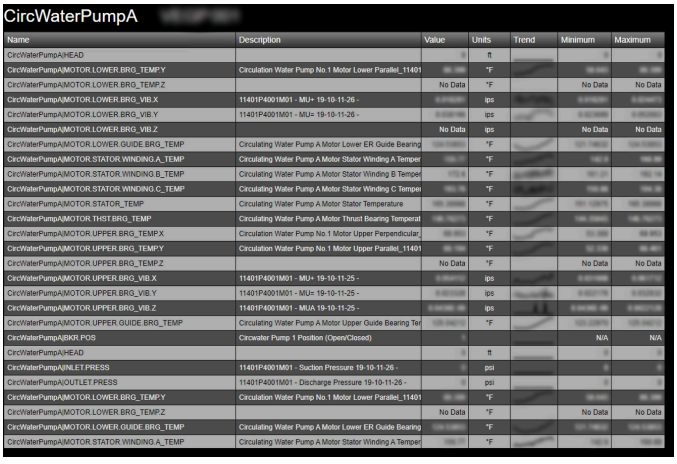
Starting their journey towards automated maintenance scheduling

The Situation

A large nuclear utility has big plans—namely, to automate! And to make that happen, they need to align specific systems through their PI servers (e.g., match PI Asset Framework (AF) with their work management application locations), meeting the needs of implementing a common information model (CIM). Identifying and matching ten thousand PI names to locations, demanding perfection, is a daunting manual task. They turned to Integral Analytics.

Upon initial inspection, we recognized that this utility didn't just need alignment, but also verification. Original data entry into PI, as well as data entry into their work management application, were manual tasks prone to human error. They are not alone. Every utility suffers from the same types of error.

Moreover, while leveraging their PI AF and Vision systems to cross-reference locations with associated names and descriptions, Integral Analytics identified a lack of standardized component displays within Vision (Figure 1). These component displays, often presented as static tables with redundant parameters, offered limited utility to Engineers, Subject Matter Experts (SMEs), and Analysts in certain scenarios. This underscored the need for a more robust and dynamic solution to support the utility's automation objectives.


CircWaterPumpA

Name	Description	Value	Units	Trend	Minimum	Maximum
CircWaterPumpA|HEAD			ft			
CircWaterPumpA|MOTOR.LOWER.BRG_TEMP.Y	Circulation Water Pump No.1 Motor Lower Parallel_11401		°F			
CircWaterPumpA|MOTOR.LOWER.BRG_TEMP.Z		No Data	°F		No Data	No Data
CircWaterPumpA|MOTOR.LOWER.BRG_VIB.X	11401P4001M01 - MU+ 19-10-11-26 -		ips			
CircWaterPumpA|MOTOR.LOWER.BRG_VIB.Y	11401P4001M01 - MU= 19-10-11-26 -		ips			
CircWaterPumpA|MOTOR.LOWER.BRG_VIB.Z		No Data	ips		No Data	No Data
CircWaterPumpA|MOTOR.LOWER.GUIDE.BRG_TEMP	Circulating Water Pump A Motor Lower ER Guide Bearing		°F			
CircWaterPumpA|MOTOR.STATOR.WINDING.A_TEMP	Circulating Water Pump A Motor Stator Winding A Temper		°F			
CircWaterPumpA|MOTOR.STATOR.WINDING.B_TEMP	Circulating Water Pump A Motor Stator Winding B Temper		°F			
CircWaterPumpA|MOTOR.STATOR.WINDING.C_TEMP	Circulating Water Pump A Motor Stator Winding C Temper		°F			
CircWaterPumpA|MOTOR.STATOR_TEMP	Circulating Water Pump A Motor Stator Temperature		°F			
CircWaterPumpA|MOTOR.THST.BRG_TEMP	Circulating Water Pump A Motor Thrust Bearing Temperat		°F			
CircWaterPumpA|MOTOR.UPPER.BRG_TEMP.X	Circulation Water Pump No.1 Motor Upper Perpendicular_		°F			
CircWaterPumpA|MOTOR.UPPER.BRG_TEMP.Y	Circulation Water Pump No.1 Motor Upper Parallel_11401		°F			
CircWaterPumpA|MOTOR.UPPER.BRG_TEMP.Z		No Data	°F		No Data	No Data
CircWaterPumpA|MOTOR.UPPER.BRG_VIB.X	11401P4001M01 - MU+ 19-10-11-25 -		ips			
CircWaterPumpA|MOTOR.UPPER.BRG_VIB.Y	11401P4001M01 - MU= 19-10-11-25 -		ips			
CircWaterPumpA|MOTOR.UPPER.BRG_VIB.Z	11401P4001M01 - MUA 19-10-11-25 -		ips			
CircWaterPumpA|MOTOR.UPPER.GUIDE.BRG_TEMP	Circulating Water Pump A Motor Upper Guide Bearing Tei		°F			
CircWaterPumpA|BKR.POS	Circwater Pump 1 Position (Open/Closed)				N/A	N/A
CircWaterPumpA|HEAD			ft			
CircWaterPumpA|INLET.PRESS	11401P4001M01 - Suction Pressure 19-10-11-26 -		psi			
CircWaterPumpA|OUTLET.PRESS	11401P4001M01 - Discharge Pressure 19-10-11-26 -		psi			
CircWaterPumpA|MOTOR.LOWER.BRG_TEMP.Y	Circulation Water Pump No.1 Motor Lower Parallel_11401		°F			
CircWaterPumpA|MOTOR.LOWER.BRG_TEMP.Z		No Data	°F		No Data	No Data
CircWaterPumpA|MOTOR.LOWER.GUIDE.BRG_TEMP	Circulating Water Pump A Motor Lower ER Guide Bearing		°F			
CircWaterPumpA|MOTOR.STATOR.WINDING.A_TEMP	Circulating Water Pump A Motor Stator Winding A Temper		°F			

Figure 1: PI Vision Tables

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The Task

Integral Analytics was engaged to execute two key initiatives: a primary project and a subsequent follow-up effort. The primary objective involved aligning PI tag names and descriptions with corresponding work management locations, while also identifying and documenting any discrepancies between the two systems. The secondary objective focused on developing a proof of concept for enhanced PI Vision displays designed to provide greater utility and improved functionality for end-users.

The Remedy

Starting with the basics, Integral Analytics reviewed all relevant data, which included exploring plant drawings, SPDS data, and a deep dive into their work management and business intelligence applications. After that, the process of finding matching work management application locations were started using PI AF as the source of truth.

As matching locations were identified, some errors were noted for the utility to correct, such as naming convention errors, unit and other identifiers that were mislabeled, and existing locations that were mismatched.

Following the location matching effort, a proof of concept was developed for one site's Circulating Water (CW) system (Figure 2). The proof of concept includes the following:

1. Basic pump and motor parameters with visualizations.
2. Pump and motor parameters compared to influence variables (atmospheric temperature, cooling water temperatures, and generator load) with basic trends and scatter plots.
3. Pump and motor related equipment visualizations compared to influence variables.
4. Fully automated pump and motor. instrumentation scores compared to EPRI's recommended instrumentation list.

"Our methodology improves data integrity across PI servers and work management applications, enabling this utility to implement an engineering solution with confidence."

– Michael Taylor, Integral Analytics

The proof of concept uses PI Vision and PI AF to compile all points and calculations. Normal software heuristics were followed, ensuring the PI Vision screens acted like any commercial software. They were created using PI Vision's asset switching capabilities; however, links were developed such that a day-one engineer can easily use this software without any knowledge of PI Vision.

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The Result

In response to these challenges, Integral Analytics developed a streamlined approach to automate alignment and verification processes. By leveraging advanced analytics and innovative tools beyond Advanced Pattern Recognition and time-series analysis, we created a solution that not only ensures accuracy but also reduces the reliance on manual information-seeking. Our methodology improves data integrity across PI servers and work management applications, enabling the utility to implement an engineering solution with confidence. This transformation not only addresses their immediate needs but also provides a scalable framework for future automation initiatives, empowering their Engineers, SMEs, and Analysts to make more informed decisions with reliable, standardized data.

Integral Analytics' mission: combine data analysis techniques with machinery knowledge to drastically improve existing software, industrial equipment, and business processes for optimal performance.

With over 90 years of combined Operations, Engineering, and Data Analytics experience, we enable real-time analytical decision-making based on human knowledge in every process, every industry, world-wide.

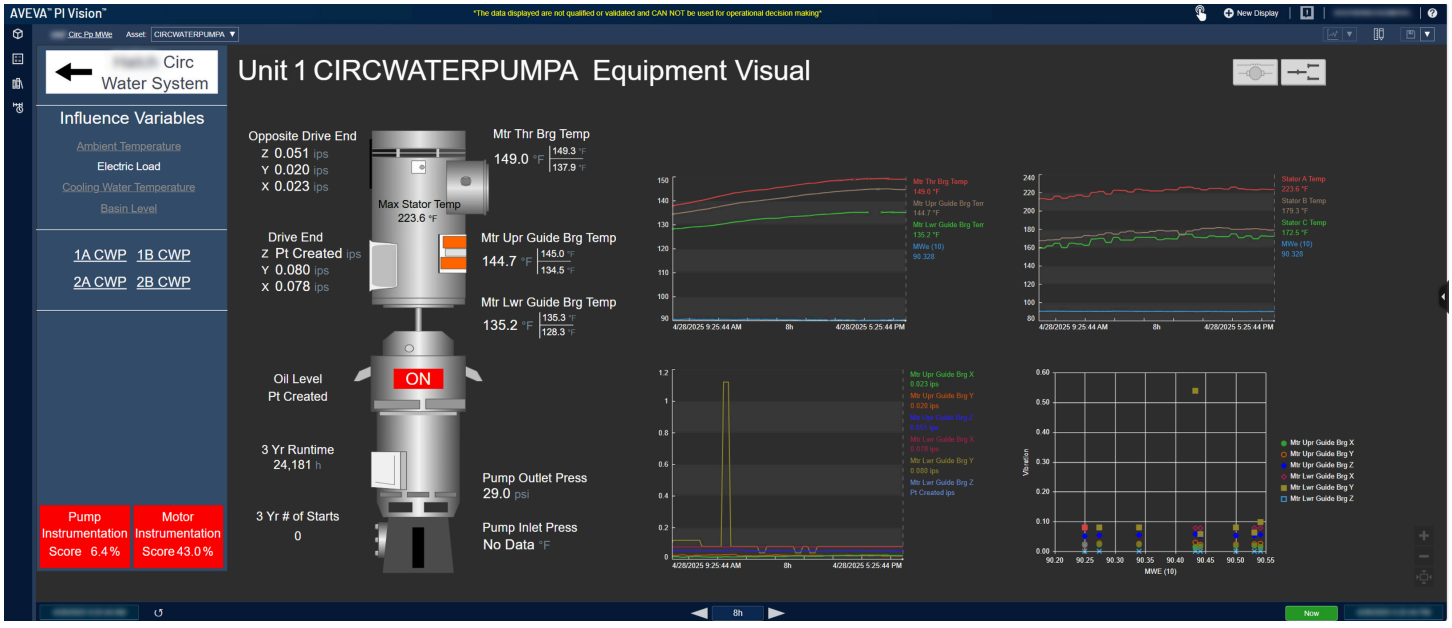

Figure 2: Updated PI Vision Screens

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