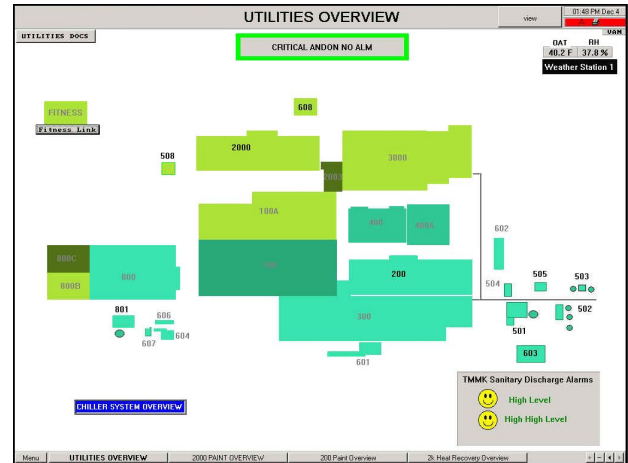




VTScada™ at Toyota Motor Manufacturing, Kentucky

How VTScada HMI software is meeting the unique challenges of one of the largest manufacturing plants in the world

By Christopher Little



Plant Utilities Overview Page

Abstract

Toyota Motor Manufacturing, Kentucky (TMMK) is not only one of the largest manufacturing plants in North America; it also has one of the strongest commitments to efficiency and environmental responsibility. For these reasons, TMMK requires an HMI software application that can reliably handle over fifteen thousand points of data and is robust enough to perform mission critical monitoring & control twenty-four hours a day, three hundred and sixty-five days a year. TMMK originally started using VTScada software from Trihedral Engineering Ltd. to monitor their enormous air compressors. They quickly decided that VTS was powerful and flexible enough to monitor all plant utilities, including tank farms, water/waste water management and production lighting.

Toyota Motor Manufacturing, Kentucky (TMMK)

The first thing visitors notice when they visit TMMK, located in Georgetown, Kentucky is that it is massive. The facility covers more than 7.5 million square feet under one roof and sits on 1,300 acres of land. It is so large it requires its own water/wastewater facilities equivalent to a small town. It even has its own on-site garden and greenhouse.

Since 1988 the plant has constructed over seven million vehicles including Toyota Avalons, Siennas, Camrys, Solaras, Camrys and Camry Hybrids. The TMMK Powertrain plant on the same property produces 2,200 engines per day for just-in-time delivery to the TMMK assembly line and for other Toyota manufacturing plants across North America.

Challenges of Monitoring & Control at TMMK

Jeff Carnage is the Technical Support Team Leader at TMMK. In 2004, he was one of those responsible for selecting an HMI/SCADA software product to provide monitoring and control for the plant's air compressors and plant utilities. He describes below some of the challenges of creating HMI application on this scale.

- **Maintaining 24/7 Mission Critical Monitoring & Control**

In 2006, Harbour Consulting ranked TMMK as the eighth most efficient auto plant in North America. Toyota has always been a leading force in the field of production efficiency having pioneered 'just-in-time delivery' methodologies on their production line. This commitment to efficiency also extends to the management of resources for the plants utilities such as compressed air, water, and electricity for plant lighting. Therefore reliable data collection and logging are paramount. Says Carnage, "Operator stations run twenty-four hours a day three hundred and sixty-five days a year. These workstations are never shut down. We need to track all of that data."

- **Handling enormous point counts**

Currently the system includes 15,000 data points. There are few facilities in the world that need to track this much information. "When you start to add this many points of data to most HMI software products you start to lose performance and develop bugs." TMMK could not afford either.

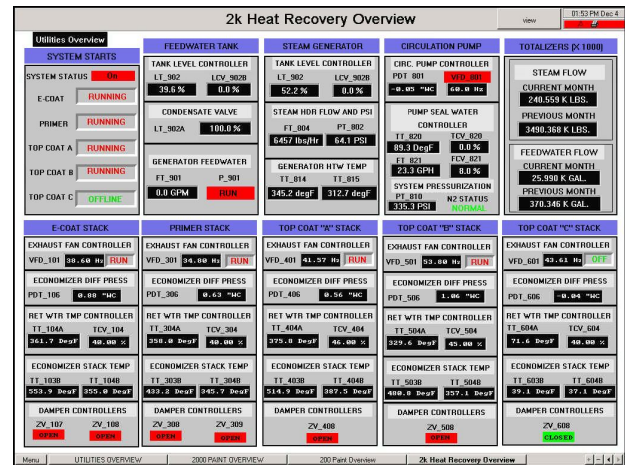


• **Displaying large amounts of information**

“The challenge is to create overview screens that give operators all the information they need to get the ‘big picture’ of critical systems without overwhelming them. It can’t be too involved or the operators become confused but at the same time they need to see at a glance whether systems are in a normal or abnormal state. It’s hard to find the perfect balance.”

• **Communicating with diverse monitoring hardware**

Of the forty-three different PLCs on the system, thirty-nine are Allen Bradley (SLC’s and ControlLogix); the other four are WAGO Modbus PLCs. TMMK needed an HMI that could communicate with all these devices and be flexible enough to incorporate other makes and models that they may wish to add in the future.



Heat Recovery Overview Page

VTScada from Trihedral Engineering

“VTScada was provided to us by a system integrator called Centrifugal Equipment Service when we upgraded our air compressor system in 2002.” This system consisted of ten large centrifugal air compressors that provided the pressurized air needed to run a wide variety of equipment across the plant such as hydraulics and paint sprayers.

Once Jeff Carnegie and his team began working with VTScada they realized that this was a product they felt comfortable working with in-house.

Advantages

- **Simple** - “One thing we liked about VTScada is the simplicity of use. We were handed an existing application from Centrifugal Equipment Service that we could use as a guide.” Almost immediately they were able to start building on this application to adapt it to their specific needs.
- **Scalable/Stable** – VTScada was designed to handle everything from standalone workstations to enormous, distributed client/server systems that include over a million tags. “The ability of VTS to handle this many points of data while maintaining processing speed is impressive.”
- **Open** - “We liked the combination of VTS and PLCs.” Thanks to its extensive library of device drivers, VTScada is non-proprietary and allows Toyota to incorporate a variety of PLC hardware.
- **Affordable** – “Cost was one of the things we considered. The cost per point of VTS is a good deal compared to Honeywell and RSVIEW.”

Expanded Use

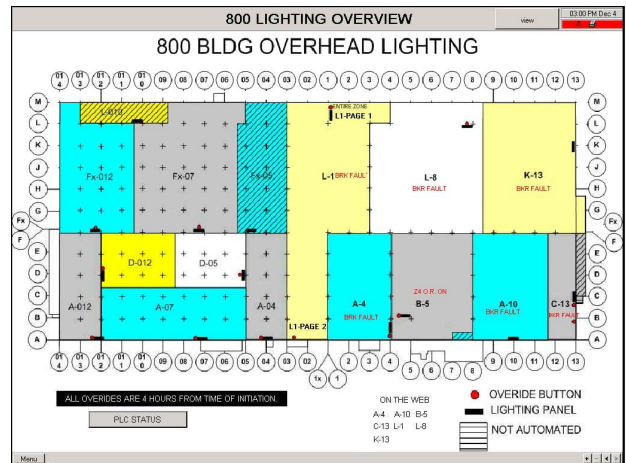
Members of the Technical Support Team attended an Advanced Configuration & Programming Course offered by Trihedral Engineering at their training center in Bedford, Nova Scotia. This training improved their core VTS programming skills allowing them to set up their own point types, drawing methods and custom reports.

With these new skills and their existing experience working with the software, the Technical Support Team began expanding the use of VTScada to monitor all of the plant’s utilities including:

- **The Tank Farm** – VTScada manages fluid resources for the production line including windshield wiper fluid, engine oil, gas, power steering fluid etc.



- **The Wastewater Pretreatment Plant** - VTScada was designed for the water & wastewater industry and features telemetry-specific features such as Polling Management, Historical Data Logging, and Industry Specific Reports.
- **The Pumphouse** – ‘All water for the plant comes into the pump house from Kentucky American and is distributed across the plant.’



Plant Lighting Overview Page

The TMMK VTScada application runs on a single development workstation with a web server and 5 internet clients where all application changes are made. Once these changes have been tested and updated, they are pushed out to VTScada runtime workstations across the utilities. Utility operators use these workstations to perform basic monitoring and control as well as real-time trouble-shooting. Engineers and management monitor the systems and data via the intranet clients.

The Technical Support Team at TMMK has created approximately 450 graphical screens for five different VTScada applications at TMMK. Every screen has sub screens that give more complete data which is useful to the plant engineers but ninety-five percent of the time the operators are using the overview screens.

“Currently the system includes 15,000 points including 1779 points that log Data at 5-6 second intervals. We are most proud of the system’s ability to take in so many data points without slowing down or developing bugs. The system is very stable.”

The Future

In 2008 the Technical Support Team plans to expand the use of VTScada even further.

- **Lighting at the Power Train plant** – “All lights are controlled via PLC so we would like operators to be able to see what lights are on, initialize over-rides, and see who has initialized an over-ride.”
- **Chiller system** – “In the future we plan to pull our chiller system into VTS. The chiller system provides cooling capacity for production and three of the plant buildings. The system has a capacity for 25,500 tons/hr.”
- **VTS Version 8.0 testing** – TMMK has an independent test environment where they can shake down new applications before using them in production. Technical Support Team is using this to test the new VTScada version due to be released early in 2008.

TMMK is eagerly awaiting new features in this release such as SQL Logging and advanced reporting tools. “We have a good relationship with the people at Trihedral. Doug Spurrell has been working with us while we have been testing VTS 8.0 in our test bed.”

“The tools are getting better all the time.”

Trihedral Engineering Ltd. Would like to thank Jeff Carnagie and of Toyota Motor Manufacturing, Kentucky for their kind assistance in writing this article.

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