SIEMENS
Ingenuity for life

Logic Matrix saves Dow and users from interlock function block spaghetti code

Jeff Sibley of Dow Chemical reports on the genesis of SIMATIC PCS 7 Logic Matrix add-on software tool, and explains how it simplifies and automates interlock programming, enabling quick visualization of process variables and interlock status without requiring users to have extensive coding skills.

By Jim Montague, Executive Editor Control Magazine

As the demands on the process engineer continue to increase, they are asked to solve intricate problems from the process automation and the IT worlds. Couple these requirements with the desire to make operators more effective and operations safer, their programming tasks can be challenging.

Fortunately, software tools like SIMATIC PCS 7 Logic Matrix (LM) have emerged that can help simplify and automate many programming tasks.

Siemens reports that Logic Matrix is add-on software for PCS 7 that makes engineering simple because complicated interlock functions are programmed in an editor using graphical cause-and-effect method-ology. The unique features of Logic Matrix that automatically generate controller code and provide HMI visualization of the process values and detailed interlock conditions simplify programming tasks, allowing the engineer to solve more complex problems.

So how was Logic Matrix developed? Glad you asked.

"We saw what Siemens Safety Matrix software was doing to automate code for PCS 7 Failsafe Safety Systems, so in 2013, we started pushing for a similar solution for basic process control systems (BPCS). We needed programming that was easier to understand and teach, would let teams focus more on functional design and less on the code, and enable the process scientist to reliably understand and modify complex interlocking."

"We wanted a programming tool that visualized cause and effect interlock programming to get away from dealing with control function charts (CFC) and the spaghetti code our interlocking required," said Jeff Sibley, R&D research scientist, Texas Innovation Center, The Dow Chemical Co., and chair of the Siemens User Advisory Board (UAB), about the inspiration for SIMATIC PCS 7 Logic Matrix software tool.

Sibley described how Logic Matrix was developed and its more recent activities in his "Logic Matrix – Real-world experiences" presentation on the second day of Siemens Automation Summit 2017 on June 28 in Boca Raton, Fla.

Logic Matrix evolution

Sibley and his colleagues submitted their idea to Siemens' U.S. product request system, wrote a research-focused use case and gave a copy to Dr. Stefan Bamburger, head of portfolio and innovation at Siemens. Subsequently, the LM beta project was started in February 2014 with help from team members, including end users Air Products, Dow and DuPont, along with system integrators aeSolutions and Pigler Automation. Logix Matrix was launched in April 2016 as part of PCS 7 Version 8.2 with the engineering tool part of the base package.

"It's critical to us in R&D because – when we have a process running right and the data is collected, the scientists always want to change it or add other reactions. So, we spend a lot of time reconfiguring previous interlocks, testing again, and constantly making changes to our operator interlock visualization that need to be refreshed by hand. This produces a lot of the spaghetti code which is susceptible to errors, and it's why Logic Matrix's ability to generate interlock code and visualization for operators is so important."along with system integrators aeSolutions and Pigler Automation. Logix Matrix was launched in April 2016 as part of PCS 7 Version 8.2 with the engineering tool part of the base package.

Siemens adds online that Logic Matrix's engineering is efficient, so bulk data interconnection options and import/export mechanisms allow shutdown parameters in PCS 7 to be quickly adapted. As a result, Logic Matrix accelerates engineering and reduces testing times in acceptance procedures for automation tasks.

In addition, LogicMatrix integrates seamlessly with the look and feel of PCS 7's controls, so process-relevant events and alarms are transmitted to the operator system and integrated with the message system. Options can be added to faceplates for accessing Logic Matrix directly, which lets operators jump directly from Logic Matrix to the event at the process tag in the process image. At the same time, all interdependencies with other measuring points are clearly depicted.

Simpler programming, better visualization

"Usually, interlock function blocks are used to protect process applications," explained Paul Morgan, consulting safety engineer at Siemens. "Users need to know high temperatures, pressures, etc., and their interrelations in processes. However, traditional interlock blocks and their Boolean true/false conditions can be hard for operators to fully understand the process conditions, and the engineering effort they require can be extensive."

"Logic Matrix was intended as a graphical cause-and-effect programming method for process problems versus responses that automatically generates the controller code with real-time visualization of process values. This method allows operators to easily evaluate and respond to current trip conditions. Many processes require additional conditioning such as filtering, delays and degraded voting schemes. These and many more are built into Logic Matrix."