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TURCK

Field Logic Controllers: The Next Generation of Control

White Paper - W1007

FLCS CREATE DEVICE-LEVEL CONTROL TO REPLACE PLCS IN SIMPLE LOGIC APPLICATIONS

Since the 1960s, programmable logic controllers (PLCs) have been the device of choice for automating and controlling machine operation, making them the head of automated processes.

In recent years, engineers have started asking why they need to invest in a PLC. The devices can be expensive, require dedicated software and often mean additional panel and wiring expenses. Is a PLC and its cost really the best option for an application that may only need to control dozens rather than hundreds of I/O points?

With the advent of the field logic controller (FLC), the answer is increasingly no.

FLC is a new category of control that brings logic programming to the device level. It is to PLCs what cell phones were to landlines – a transformation in flexibility, control and potential. FLC empowers engineers, OEMs and system designers to add simple logic to applications via Ethernet I/O blocks with built-in FLC technology. It can be used in conjunction with PLCs or as a standalone solution that removes PLCs from the equation entirely.

One of the primary FLC advantages for automation experts is saving on the expense of upgrading, buying or replacing a PLC to gain I/O points and connections. It also brings control outside the panel and into challenging field environments, because the blocks carry advanced IP ratings for ingress protection. Additionally, FLC technology makes programming accessible to engineers of all experience levels because of its straightforward and streamlined interface and design.

By reducing the amount of software and hardware required in manufacturing, FLCs enable more flexible and cost-effective programming for engineers and organizations. It is technology that unlocks the potential of I/O blocks for a revolution in logic and control that doesn't require dedicated software to purchase or license.

THE ORIGINS OF FLC, AND HOW IT WORKS

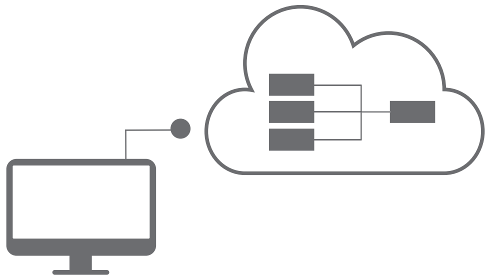
Turck developed the first FLCs as advances in microprocessor technology enabled a better control and programming solution for end-user challenges.

The cost of PLCs and the complex, dedicated software required have been an ongoing concern for engineers. User demand was building for simple logic with a clean, web browser-based interface that anyone could program. It was time to build an industrial automation programming environment that was as easy to use as consumer devices.

At the same time, microprocessors grew more powerful and less expensive, which allowed advanced functionality without increasing end-user cost. These advancements mean I/O blocks can manage both standard I/O functions and the control responsibilities that were formerly only capable through PLCs, and for a fraction of the cost.

To make this control possible, today's FLC technology uses a flow chart system to custom program local Ethernet I/O blocks via an HTML5-compatible web browser, such as Chrome and Mozilla Firefox. Through a series of drop-down menus, engineers can set up multiple conditions, operations and actions on one block.

- Conditions correspond to input conditions. Examples of conditions include a timer expiring, a counter expiring or reaching a value, or an input from a sensor becoming true.



- Operations include Boolean operations, such as "and," "or" and "not."
- Actions correspond to output conditions and tell the block the desired action to execute.

When a condition is true, actions run. Where before this functionality was only possible through PLCs, FLCs can easily manage these communications on their own. They also allow users to write, run, simulate and debug code. Signaling a pump to turn on or off based on liquid level is an example of how this programming might work.

The I/O block is connected to a level sensor. The sensor monitors the liquid level in a tank and reports back to the block. The ideal level is 50 units, to prevent overfill or the pump running dry. For this application, FLC technology can be used in place of a PLC to program the block to signal one of three actions:

- When the value is above 50 units, the condition is true. A pump will turn on to return liquid to its ideal level.
- When the value is below 50 units, the condition is true. More liquid will flow into the tank or a pump will be turned off until it reaches the ideal level.
- When the value is 50 units, the condition is false.

No action will be taken because the liquid is at its ideal level.

Engineers can choose to access different capabilities of FLC technology based on the application. These capabilities include toggle buttons to signal on/off, arithmetic functions, timers and counters, monitoring via HMI, and defining variables to communicate with PLCs.

When first activating the block's technology, the programmer enters the unique IP address to access the block and programming environment. All programming is managed through an HTML5-compatible web browser, and uploaded via an Ethernet connection to the block. This design allows users to program FLCs via any handheld device, such as a tablet or smartphone, which are more readily accessible in the field than PCs.

FLC TECHNOLOGY ENABLES THREE CONTROL CONFIGURATIONS ACROSS INDUSTRIAL ENVIRONMENTS

Because FLC technology offers control at the device level, it delivers a more cost-effective programming solution than PLCs. FLCs can also go into harsh environments or outside the panel where ratings above IP20 are required. There are three primary use cases and configurations for FLC technology:

- Standalone logic controller: This was the inspiration for the FLC, and is its primary use. After accessing the programming environment, engineers can use the flow chart interface to program and upload logic directly to the multiprotocol Ethernet I/O block. The block will carry out the actions and report back. No PLC is required.
- Local backup for a PLC: For more complex systems,

FLC can be used as a local backup for a PLC. If the PLC loses power or connection, FLC technology can do one of two things: either take over the application and run it from the block, or take over the application and safely shut down the process. This can help avoid downtime and troubleshoot where a problem exists on the line.
- Partner for PLC processing: FLC can also be used in tandem with the PLC, as distributed control in larger automation environments. The FLC-capable I/O block can locally monitor and control an application and compile data, and send that data via defined variables to the PLC to lighten its data input and output load. This is helpful in high speed applications, such as conveyor belts, where sending data in real time (network latency) can be problematic.

With these cases, the user can set variables to know when information is stored. If applicable, variables can indicate when a PLC is connected and data is communicated to and from a PLC. FLC is not currently suited for high-speed motion applications, as the minimum scan cycle is longer than the required safety/shutdown response times. Another limit at this time is the ability for an FLC to control or monitor I/O from other I/O devices on the Ethernet network.

FLC will have wide-ranging implications for control in automated applications, especially as the cost of PLCs and similar technology increases. It is especially effective in simple sensing applications where there needs to be better communication integration into larger PLC-controlled applications.

Some early adopters have already realized the benefits of FLC technology in standalone uses, by bringing communication and control to the device level.

- Pick-to-light assembly: This application is prevalent at small assembly stations. As visual cues for assembly, lights turn green or red based on accurate assembly of parts. One company also programmed lights to help with assembly efficiency. An assembler pushes a button when a part bin is empty, alerting floor supervisors to refill the bins. This on-off functionality can be programmed through FLC as a standalone function, but could easily be used to integrate with PLC-controlled applications.
- Liquid level measurement: A milk processor used standalone FLC to solve the issue of how much milk was in a tank. If a sensor measures milk above a fill line, a motor is turned on and liquid pumped back to a reserve tank. If below the fill line, the pump stops to allow the tank to refill.
- Metal finishing: One company wanted a better way to manage communication for finishing metal parts, and chose FLC technology to update its processes. It connected a sensor that reads the level of roughness on the surface of a part to an Ethernet I/O block programmed with FLC technology. Based on the sensor's reading, the part is automatically sent to the appropriate station for honing and polishing.

FLC PAIRS WITH RFID AND IO-LINK TO SIMPLIFY SYSTEMS AND EXPAND I/O CAPABILITIES

In addition to simple logic applications, FLC technology can be used to elevate and improve RFID systems and IO-Link control.

IO-link is a point-to-point serial communication protocol used to communicate with sensors and actuators. It enables companies to add I/O points to lower-cost PLCs without the need to invest in or upgrade to a more expensive PLC.

FLC takes this one step further by allowing engineers to create high-density I/O without a PLC. Take as an example a conveyor belt that requires 128 sensors. Rather than control the system from a PLC, IO-Link-capable I/O blocks with FLC technology can be used to control these 128 sensors. When FLC technology is utilized on the I/O block, engineers can control, view and adjust parameters from the FLC interface with a few changes to programming code.

RFID is another area where FLC's unique logic capabilities help streamline operations. RFID can be an inherently complex system, but FLC allows engineers to add read/write capabilities to any block. Digital and analog I/O slices can be in the same block.

Parts to be packaged are a basic example of this technology at work. Each part has an RFID tag, and each box needs to be loaded with 12 tagged products before the box is moved. A light needs to switch on to signal when a box is full.

With FLC, that functionality can be programmed directly to the block. Each time a tagged product passes a sensor, FLC logs the value. Once the total value equals 12, the light goes on for a set time, and the counter restarts.

NEW MARKETS AND USES ON THE HORIZON FOR FLC

With the introduction of FLC, engineers are able to build more cost-effective control solutions for simple applications. What before involved the investment in a PLC can now be managed through Ethernet I/O blocks with built-in FLC technology.

Whether used as standalone platform or in conjunction with a PLC, FLC enhances control capabilities that require simple logic in applications. It takes control to a new level where PLCs can't easily go alone.

"FLC will transform how the automation industry thinks about control and control systems," said Dave Lagerstrom, president and CEO of Turck, Inc. "As this technology advances, we can see control capabilities expanding, allowing engineers to create entire standalone control systems using the FLC platform."

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