

Digital I/O Monitor Channel for the Mu-4000

Programmable Logic Controllers (PLCs) are designed to cleanly separate the control and/or management planes (e.g., interactions between the PLC and an HMI – clearly requiring an active wireless, Ethernet or serial network connection) from the “business end” of the PLC: The “Digital I/O” interfaces that enable the PLC to control a process.

In particular, certain PLCs are custom-designed for special-purpose semi-autonomous deployments with the expectation that they operate correctly even when disconnected from their parent HMI (e.g., “safety PLCs”). In such scenarios, it is increasingly important for a PLC to keep doing its job regardless of whether a bi-directional data path exists between the PLC and its HMI. Such a PLC should not experience a “loss of control” – even when the PLC loses connectivity to the HMI.

In contrast, other PLCs may be deployed or applied more interactively, in that they may require alarm conditions at the HMI to be acted on by automated control programs (or humans) either of which might be impossible if the HMI has lost visibility into the real-time state of the PLC. If the PLC cannot transmit an alarm due to a lack of network connectivity, the HMI will clearly not act upon it since it cannot know about it.

Visibility Critical For Continuously Safe Operations and Service Assurance

A “loss of visibility” happens when the network path between the HMI and the PLC is interrupted, such as when the network is down, or when a programming flaw disables the network stack in the PLC such as when it was unable to properly interpret a packet, rendering the PLC unreachable. Whenever there is a loss of visibility, no matter how complete, no matter the cause, the HMI is unable to influence the process, or perhaps to even to learn the state of that process. Proactively discovering these weaknesses is the primary role of the Mu-4000 analyzer platform. For many industrial control system applications, it is critical to have a network interface that is highly reliable, available, and secure.

So in some cases, it is useful to have the ability to monitor the PLC’s Digital I/O independently of the network interface and stack as the basis for automatic fault detection and isolation to ensure that no matter what the state of the network interface or the network stack in the CPU board of the PLC, the PLC’s Digital I/O still keeps doing its job.

Considering these requirements, it is sometimes desirable for industrial control asset owners and suppliers to use a “Digital I/O Monitor.” Therefore, to support those cases where such direct monitoring is required, the Mu-4000 supports a new type of hardware-based monitor channel in the form of an optional USB-attached hardware module, taking its place alongside the built-in channels.

Automatic Fault Isolation Is Based on a Broad Set of Monitor Technologies

Hardware

- 1) Serial console ports (DB-9; hardware);

Software

- 2) SNMP;
- 3) SSH;
- 4) syslog; and
- 5) TELNET.



This optional monitor interface supports configuration of voltage range (e.g., low (0.0–0.7V) or high (2–28V) voltage), frequency tolerance settings, etc. as fault criteria specific to Digital I/O. Upon sensing a user-defined fault condition, the Digital I/O Monitor triggers the Mu-4000 to register the fault, isolate it and potentially initiate restarter procedures – similar to how the Mu-4000 uses other types of monitor channels.

Even without this purpose-built Digital I/O Monitor channel, the Mu-4000 is able to monitor these digital I/O signals today via an SSH or TELNET connection to a PC with a DAQ card. With this new optional enhancement, the award-winning Mu-4000 enables customers to choose the ease-of-use of an integrated Digital I/O Monitoring solution that directly verifies the availability of all parts of a PLC under the widest variety of adverse network conditions as a complement to the comprehensive Mu-4000 feature set, including Mutation and Denial of Service (DoS) capabilities.

Mu delivers a rigorous and streamlined methodology for verifying the reliability, availability and security readiness of any IP-based product or application. Since the debut of Mu’s flagship Mu-4000 platform in late 2005, the company has achieved significant customer adoption. The award-winning Mu solution is deployed at more than 100 locations, primarily at leading global service providers, cable operators and network product vendors. Mu’s customers also represent one-third of the revenue in the global industrial control systems manufacturer market.

Mu Dynamics proactively eliminates the high cost of service, application and network downtime. Mu’s solution automates a systematic and repeatable process that identifies hard-to-detect sources of potential downtime within IP services, applications, and underlying networks. The award-winning Mu solution is deployed at more than 100 locations, primarily at leading global service providers, cable operators and network product vendors. Headquartered in Sunnyvale, California, Mu is backed by leading venture capital firms that include Accel Partners, Benchmark Capital, DAG Ventures and Focus Ventures.