Nuclear Automation

Advanced Logic System® Service Unit

Background

The ALS service unit (ASU) provides Advanced Logic System® (ALS®) platform system status and maintenance functionality to plant personnel during plant operation. The ASU provides access to advanced features of the ALS platform system such as system diagnostics, post-trip analysis, monitoring real-time operation, initiating various run-time tests, and performing test, calibration and maintenance operations.

Description

The ASU is a computer-based human-machine interface (HMI) system. The ASU communicates with the ALS platform subsystem via a non-control related test ALS bus (TAB). This bus is designed to be non-intrusive in the sense that it cannot interfere with the regular control related processing of the ALS subsystem. In addition, TAB communications between the ALS platform subsystem and the ASU are only enabled when a physical "COMM Enable" key switch is actuated.

Depending on project requirements, the ASU computer can additionally receive data from the ALS-102 TxB communication channel. This data can be provided continuously to allow real-time monitoring of contact input/output states, analog input/output states, internal states (including counter values, analog computed values, etc.), board and system integrity, and application-specific operational data. This ALS-102 TxB communications channel is one-way only, from the ALS-102 to the ASU, so that the ASU cannot disrupt ALS functions while monitoring.

The ASU can be a device that is permanently attached to the ALS platform subsystem, or it can be a portable device brought to the ALS subsystem and temporarily connected.

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The main features that can be provided by the ASU, depending on system requirements, are:

- **State Information** – Features monitoring of real-time operation, including all input/output signals, as well as detailed status information from debugging registers. The advanced monitoring capabilities provide fast system diagnostics and troubleshooting.
- **System and Board Information** – Provides detailed information about the configuration of an ALS platform system, including board information such as field programmable gate array (FPGA) program version, build information and configuration.
- **Blackbox** – The ASU may include a blackbox functionality, where all events of an ALS platform system are recorded. This allows plant personnel to inspect the ALS platform system's reaction to a past event. The blackbox helps reduce the time it takes to pinpoint the cause of a series of events.
- **Test** – Application-specific periodic surveillance tests can be implemented to be performed through the ASU. Based on the needs of the application, features may be implemented in the core logic board that allow surveillance testing to be performed and/or monitored through the ASU.
- **Calibration** – The ASU is used to read out and change application setpoints and channel calibration coefficients. The core logic board holds the application setpoints; according to the application, it will allow the ASU to modify these setpoints. The ASU is also used during input/output channel calibration for selecting the board and board channel to be calibrated, and to change calibration coefficients based on the readings received on an external calibrator. This calibrator will typically be an industry standard process calibrator traceable to a National Institute of Standards and Technology (NIST) standard.

Benefits

Adaptability – Different configurations of the ASU are possible to support different implementation needs (permanent connection or temporary connection). The ASU supports a variety of implementation possibilities including a dedicated ASU that is permanently connected to the ALS or a laptop that is temporarily connected when needed. The HMI displays can be customized for the specific application.

Passive – The ASU operation is passive and non-intrusive, i.e., it can only modify the safety system tunable parameters stored in the non-volatile memory for which it is designed (e.g., input/output calibration coefficients, setpoints and tuning constants). It is not possible to modify the safety channel algorithm. All communications initiated by the ASU take place on the TAB bus. No reliable ALS bus (RAB) interruption can occur, which effectively leaves the safety operations of the ALS system unaffected.

Cyber Security – The ASU software package operates on a standard Windows® operating system or a QNX®-based PC node box as applied in the Westinghouse Common Q™ platform. This design allows the non-safety application to be integrated into existing site cyber security programs. Standard security controls can be applied in accordance with a licensee's security control implementation strategy.

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