

ALS-402 Solid State Relay Output Board

Background

The ALS-402 solid state relay output board is a member of the Advanced Logic System® (ALS®) platform, providing 16 independently isolated solid state relay outputs that may be used over a wide range of contact switching applications. Each independent single-pole solid state relay output channel supports both AC and DC field circuits. These output channels can drive external alarms and plant indicators, and include adequate isolation interfacing with non-safety systems. Each optically isolated output channel can switch field circuits up to 1A at 150Vrms (AC or DC).

Description

All output channels are optically isolated and capable of withstanding 1,500 Vrms between field and logic circuits. The ALS-402 also provides automatic self-test and field-continuity test features to maintain signal and channel integrity. All output channels are surge protected to prevent permanent damage from momentary faults.

The ALS-402 channels receive the output state value from the core logic board via the reliable ALS bus (RAB). Each output channel drives its output as commanded by the core logic board (CLB). Each output channel can be configured to fail-as-is or fail-as-defined upon loss of RAB communications from the core logic board.

The ALS-402 channels conduct self-testing to provide channel integrity. The integrity check is performed by comparing the commanded output value (the channel output state) with the expected read-back value. Each channel can determine if the output is being driven correctly.

The status indication includes the standard ALS platform indications as well as the following channel-specific indications:

- Output value mismatch or integrity error
- Channel in bypass
- Channel in override
- Channel disabled

The ALS-402 allows for customization of each individual channel:

- Enable or disable the channel
- Enable or disable the channel continuity checking (field wiring)

Additional detailed information regarding the board configuration, diagnostics and status is also available via the ALS service unit (ASU).

The ALS-402 is designed for autonomous operation, allowing the system level design to maintain the overall integrity of the application, whether a fault occurs within the individual board or at the system level. A failure in one channel does not impact the other channels.

The ALS-402 incorporates a common implementation approach with all ALS platform

boards. Component reuse and circuit design reuse is a key aspect of the ALS platform, providing long-term reliability and mitigation of obsolescence issues. Additionally, the common implementation provides a common look and feel to all ALS platform boards for ease of maintainability.

The ALS-402 was subjected to a board level reliability analysis so that the highest level of reliability is achieved. Additionally, the ALS-402 was subjected to a failure modes and effects analysis (FMEA) at the individual component level.

The ALS-402 is designed by Westinghouse and is built and manufactured under Westinghouse control per an approved 10CFR50 Appendix B Quality Assurance program. The processes and procedures for the design and development have been reviewed and approved by the U.S. Nuclear Regulatory Commission for use in Class 1E systems.



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Benefits

The ALS provides a common platform solution for all Class 1E safety system applications in the nuclear power plant. The ALS is a hardware-based architecture that uses a minimal set of hardware to implement a system with high integrity and reliability. The platform is modular so that common individual boards can be mixed and matched to achieve an overall solution for a given application. The ALS is scalable so that replacements can be performed on a system-by-system basis.

The ALS-402 provides:

- 16 isolated solid state relay channels
- High reliability, optically isolated solid state relays
- Surge and over-voltage protection
- Built in continuity and fault detection
- Autonomous board operation
- Ability to be hot swapped

Electrical Specifications

Number of channels	16 isolated solid state relay channels (SSR)
Switched output voltage	150 V _{RMS} or 150 V _{DC} maximum
Switched output current	1A maximum (continuous), 5A (100ms)
Output response time	< 40ms
Output contact leakage	< 1ma at 150 V _{DC} and 150 V _{RMS}
Self-test	Performed automatically
Isolation	Inter-channel 300 V _{RMS} and 300 V _{DC} Group to group 750 V _{RMS} and 750 V _{DC} Channel to logic 1,500 V _{RMS} and 1,500 V _{DC}

Power Requirements

Power consumption	Less than 3 watts from ALS chassis power supply
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Environmental

Standard operating temperature range	5 C to +60 C
Storage temperature range	-20 C to +70 C

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