

ALS-421 Analog Output Board

Background

The ALS-421 analog output board is a member of the Advanced Logic System® (ALS®) platform, providing high performance analog output capabilities. The ALS-421 provides eight independent high integrity and highly accurate analog output channels, which can be individually configured for voltage mode or current mode operation. The ALS-421 supports industry standard current loops and voltage outputs to provide compatibility with the existing indicators and receivers located in the plant.

Description

The ALS-421 supports the most popular voltage mode configurations such as 0 to 5V, -5 to 5V, 0 to 10V and -10 to 10V.

The ALS-421 supports the most popular current mode configurations such as 4 to 20mA, 0 to 20mA, 4 to 22mA and 0 to 22mA outputs.

Each input channel is highly accurate, linear and extremely stable over temperature, aging and component spread.

The eight channels are powered from an isolated on-board power supply capable of withstanding 1,500 Vrms. The eight output channels are independent, but located on a common isolation domain. The board may be used over a wide range of applications with different channel and wiring configurations.

The ALS-421 provides automatic self-test features which, in an overlap approach, maintain the integrity of the output signal from the ALS core logic board through the transmission on the busses and through the output channel to the end receiver.

The ALS-421 channels receive the digital channel value and state information from the core logic board via the reliable ALS bus (RAB). Each channel performs the digital-to-analog conversion and drives the output channel to the specified voltage or current, depending upon the configuration of the channel.

The ALS-421 channels conduct self-testing to provide channel output integrity. This integrity check is performed by comparing the actual value (the channel output current or voltage) with the expected value, i.e., the value requested by the core logic board through the RAB. This is done using a feedback loop with an analog-to-digital converter sensing the actual level sent to the field. Each channel can detect a difference between the desired analog value and the actual analog value output to the receiver. Additionally, each channel can determine if the output is being driven correctly, and thus detect a “failed” channel.

All channels are surge protected, short circuit protected and over-voltage protected to prevent permanent damage.

The ALS-421 supports online calibration of individual sensor channels. Each channel is independently calibrated with OFFSET and SPAN. Only the channel under calibration is impacted, and therefore requires only one channel to be bypassed at a time. Calibration of a channel while online is achieved by utilizing the ALS service unit (ASU). Additional detailed information regarding the board configuration, diagnostics and status is also available via the ASU.

The ALS-421 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-421 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.

The ALS-421 was subjected to a board level reliability analysis so that the highest level of reliability is achieved. Additionally, the ALS-421 was subjected to a failure modes and effects analysis (FMEA) at the individual component level.

Benefits

The ALS-421 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.



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Electrical Specifications

Number of channels		8 independently isolated outputs
Output modes	Voltage mode	0V to 5V -5V to 5V 0V to 10V -10V to 10V
	Current mode	4mA to 20mA 0mA to 20mA 0mA to 22mA 4mA to 22mA
Maximum output loading	Voltage mode	>1k Ω
	Current mode	>800 Ω

Analog Conversion

Resolution	16 bit ADC conversion
Update rate	<1ms
Response time	<20ms
Settling time	<50ms

Output Error

Accuracy	$\leq \pm 0.1$ percent relative to full scale
Temp. drift	$\leq \pm 0.01$ percent/C relative to full scale
Long term drift	$\leq \pm 0.01$ percent relative to full scale

Power Requirements

Power consumption	Less than 11 watts from ALS chassis power supply
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Environmental

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

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