ALS-321 Analog Input Board

Background

The ALS-321 is a member of the Advanced Logic System® (ALS®) platform, providing high performance analog input capabilities. The ALS-321 provides eight independent isolated high-integrity and highly accurate analog input channels, which can be individually configured for voltage mode or current mode operation. The ALS-321 supports industry standard current loops and voltage outputs to provide compatibility with the existing sensors and transmitters located in the plant.

Description

The ALS-321 interfaces with standard current loops and provides the option, for each channel, of using an internal dropping resistor located in the analog circuitry on the board, or by using an external precision dropping resistor between 90-210 Ω. The external dropping resistor is typically located on the terminal blocks of an assembly panel within the cabinet. If the external resistor option is utilized, then the channel will operate in voltage mode.

The ALS-321 supports the most popular voltage mode configurations such as 0 to 10V or -10V to 10V inputs.

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

Process instrument loop power is provided by an external loop power supply from a cabinet-mounted or remote power-supply. The board may be used over a wide range of applications with different channel and wiring configurations.

The ALS-321 provides automatic self-test features which, in an overlap approach, maintain the integrity of the measurement from the sensor through the ALS-321 board and transmission to the ALS core logic board for logical decision making.

Each channel performs a self-test to maintain integrity of the individual channel. Additionally, the channel provides "out-of-range" detection and automatic recovery from an overload condition. Surge and over-voltage protection is provided for all inputs. Channel status and board status are visible on the front panel indicators, providing a quick status assessment for the board.

The analog inputs are converted into digital values representing the detected current or voltage levels and are made available on the reliable ALS bus (RAB) together with integrity information for each channel. The ALS-321 senses voltage from an external voltage source/transmitter or current from an externally wetted and controlled current source/transmitter, and uses a high precision sigma-delta analog-to-digital converter to convert the raw sensor data into highly accurate digital readings. The information is made available on the RAB bus, where it is provided to the core logic board upon request.

The ALS-321 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.

Westinghouse

The ALS-321 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-321 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-321 was subjected to a board level reliability analysis so that the highest level of reliability is achieved. Additionally, the ALS-321 was subjected to a failure modes and effects analysis (FMEA) at the individual component level.

Benefits

The ALS-321 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		Eight galvanically isolated inputs
Input modes	Voltage mode	0V to 5V
		-5V to 5V
		0V to 10V
		-10V to 10V
	Current mode	4mA to 20mA
		0mA to 20mA
		10mA to 50mA
		0mA to 50mA

Analog Conversion	
Resolution	24 bit ADC (17 effective bits)
Scan rate	90Hz ±5Hz
Response time	90ms (min digital filtering)
Settling time	400ms (min digital filtering)
Measurement Error	
Accuracy	≤±0.1 percent relative to full scale
Temperature drift	10ppm/C relative to full scale
Long term drift	18ppm/year relative to full scale
Power Requirements	
Power consumption	Less than 3 watts
Environmental	
Standard operating temp. range	5 C to +60 C
Storage temp. range	-20 C to +70 C