Nuclear Automation

ALS-601 Communications Board

Background

The ALS-601 board is a versatile, highly reliable communications board with eight independent and isolated channels capable of EIA-422 or EIA-485 communications. The target application for this board is providing highly reliable communication links between Advanced Logic System® (ALS®) platform racks, communications to/from third party equipment, communications to a plant computer and communications to data-logging equipment.

Description

The ALS-601 receives reliable ALS bus (RAB) request packets with data and transmits the data through the isolated communication output channels. The communication board also receives data/packets and makes received information available to the RAB.

The ALS-601 supports a "byte mode" where data is transmitted one byte at a time. In this mode, the ALS-601 relies on the ALS-102 core logic board to perform higher-level data synchronization and integrity checking. The "byte mode" is used to communicate with simple display devices or legacy devices, where the ALS-601 must conform to an existing packet format.

The ALS-601 also supports a "packet mode," which is advantageous when the ALS-601 is used to transfer data to another ALS rack with a corresponding ALS-601. In "packet mode," the ALS-601 will encapsulate data sets in a packet format with a header and a checksum. The receiving ALS-601 automatically synchronizes to the header information and checks and strips the checksum. The packet mode may also be used when sensor data is sent to third-party equipment as long as it conforms to the ALS-601 packet format.

Each channel operates uni-directionally (either receive or transmit). When a channel is configured for receive mode, the unused transmitter is disabled by the ALS-601; similarly, when a channel is configured for transmit mode, the unused receiver is disabled.

All communication channels are galvanically isolated from the ALS logic and from each other. Communication channels are isolated and capable of withstanding 1,500 Vrms between field and logic circuits. All communication channels are surge protected to prevent permanent damage from momentary faults.

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Each ALS-601 communication channel includes a built-in self-test loop-back feature used to detect transceiver failures. All looped back data bits are compared by the field programmable gate array (FPGA) with the previously transmitted data bits. Self-test capabilities provide detection communication failures in the channel, the FPGA logic circuits, the configuration of non-volatile memory and the power management logic. The integrity for each channel is indicated locally and reported to the core logic board.

The ALS-601 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-601 was subjected to a board level reliability analysis so that the highest level of reliability is achieved. Additionally, the ALS-601 was subjected to a failure modes and effects analysis (FMEA) at the individual component level.

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Benefits

The ALS-601 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-601 provides:

- Eight independent and isolated communication channels
- Bi-directional EIA-422 full-duplex capability
- Baud rates of up to 921,600
- Byte mode and/or packet mode operation
- Self-testing
- Surge and over-voltage protection
- Ability to be hot swapped

Electrical Specifications		
Number of channels		Eight channels
Type of channels		Serial communication
Interface(s)		EIA-422 or EIA-485
Baud rates(s)		4,800; 9,600; 19,200; 38,400; 57,600; 115,200; 230,400; 460,800; 921,600
Interface over-voltage protection		+/- 5V
Isolation		
	Channel to channel	500 V_{RMS} and 500 V_{DC}
	Channel to logic	1,500 V_{RMS} and 1,500 V_{DC}
	Channel to earth	750 V_{RMS} and 750 V_{DC}
Power Requirements		
Power consumption		Less than 5 watts from ALS chassis power supply
Environmental		
Standard operating temperature range		5 C to +60 C
Storage temperature range		-20 C to +70 C

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