AUTOMATIC DATA BUS WIRE INTEGRITY VERIFICATION DEVICE

FIELD

The present disclosure relates to verifying integrity of electrical wiring, and more particularly to a device and method for automatically verifying the wire integrity of a bus, such as a controller area network (CAN) bus or other electrical connections on an aircraft or other vehicle.

BACKGROUND

Modern aircraft are complex devices that include multiple different systems. Many of these systems may be electrically interconnected for transmitting data and for controlling the different systems. The electrical interconnections between aircraft systems may include multiple data buses with hundreds of wire interconnections. For example, a Boeing 787 currently has 134 controller area network (CAN) buses that interconnect through 21 bus gateways or remote data concentrators (RDC) representing hundreds of wire connections. Wire connectivity is currently solely determined by Airplane (AP) system functionality after installation and power on. CAN line replaceable units (LRUs) are turned on and the maintenance system is observed for any communication faults. CAN is a robust communication protocol and CAN LRUs can still maintain communication through several types of build errors. By design, the CAN bus is fault tolerant making it difficult to detect build errors using system functionality. Therefore, hard or intermittent faults can be missed by current verification procedures during installation. Additionally, individual wire checks are extremely time consuming and faults can still be missed if subtle faults on the CAN bus are intermittent. Accordingly, there is a need for a device for reliably verifying bus wire integrity that can be done efficiently, with minimal cost and does not require a specially trained person to observe the bus for the subtle failures.

SUMMARY

In accordance with an ~~embodiment~~aspect of the present invention, a device for verifying wire integrity of a bus may include a bus connector configured to connect a bus comprising a plurality of wires. The device may also include measurement circuitry configured to perform a verification test on ~~selected wires~~ each wire of the bus. The verification test of ~~the selected wires~~each wire may include connecting a ~~selected~~ wire under test

in a predetermined configuration relative to the other wires for performing the verification test and measuring a value of an electrical parameter associated with the ~~selected~~ wire under test. The verification test may also include comparing the value of the measured electrical parameter associated with the ~~selected~~ wire under test to an expected value of the electrical parameter. The ~~selected~~ wire under test passes the verification test in response to the measured value of the electrical parameter corresponding substantially to the expected value of the electrical parameter.

In accordance with ~~another~~ an embodiment, a device for verifying wire integrity of a bus may include a bus connector configured to connect to a controller area network (CAN) bus connector. The CAN bus connector may be configured for connecting a plurality of CAN buses to a data concentrator. Each CAN bus may include a shielded twisted pair of wires including a CAN high wire, a CAN low wire and a CAN shield wire. The device may also include measurement circuitry configured to perform a verification test on at least the CAN high wire and CAN low wire of each CAN bus. The verification test of each CAN bus may include connecting a wire under test in a predetermined configuration relative to the other wire for performing the verification test and measuring a value of an electrical parameter associated with the wire under test. The verification test may also include comparing the value of the measured electrical parameter associated with the wire under test to an expected value of the electrical parameter. The wire under test passes the verification test in response to the measured value of the electrical parameter corresponding substantially to the expected value of the electrical parameter.

In some embodiments of the present invention in combination with any of the above embodiments, the device may include a hand-holdable portable housing with the measurement circuitry contained in the housing. A user interface for controlling operation of the device may be provided on a face of the housing. Information related to the verification tests may be presented on a display of the user interface. The information may include test results and an identification of the bus on which the verification test is being performed based on reading a pin configuration setting of the bus by the device.

In some embodiments of the present invention in combination with any of the above embodiments, a device for verifying wire integrity of a bus may include an interface for connecting to the bus that is configured to select subsets of a plurality of wires in a connector of the bus for testing. The device or interface may automatically select a subset of wires of the bus

and run the verification tests. The device or interface may then select another subset of wires without requiring user interaction. In this manner, all wires of the bus may be automatically verification tested.

In some other embodiments of the present invention and in combination with any of the above embodiments, the verification test may include detecting a short circuit between the wire under test and another wire of the bus and detecting a short circuit between the wire under test and a ground potential. The verification test may also include indicating that the wire passed the verification test in response to not detecting the short circuit between the wire under test and the other wire of the bus and not detecting the short circuit between wire under test and the ground potential.

In accordance with ~~a further embodiment~~another aspect of the present invention, a method for verifying wire integrity of a bus may include detecting connection to a bus connector. The bus connector may be configured to connect a plurality of buses to an apparatus and each bus may include a plurality of wires. The method may also include automatically performing a verification test of each bus. The verification test of each bus may include connecting a wire under test in a predetermined configuration relative to the other wire by measurement circuitry for performing the verification test and measuring a value of an electrical parameter associated with the wire under test. The method may also include comparing the value of the measured electrical parameter associated with the wire under test to an expected value of the electrical parameter. The wire under test passes the verification test in response to the measured value of the electrical parameter corresponding substantially to the expected value of the electrical parameter.

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF DRAWINGS

The following detailed description of embodiments refers to the accompanying drawings, which illustrate specific embodiments of the disclosure. Other embodiments having different structures and operations do not depart from the scope of the present disclosure.

FIG. 1 is a block schematic diagram of an example of a device for verifying wire integrity of a bus in accordance with an embodiment of the present disclosure.