Fiber Optic Bus Principle



Overview

The history of PROFIBUS goes back to a publicly promoted plan from Marco Todaro for an association which started in Germany in 1986 and for which 18 companies and institutes devised a master project plan called "fieldbus". The goal was to implement and spread the use of a bit-serial field bus based on the basic requirements of the field device interfaces. For this purpose, member companies agreed to support a common technical concept for production (i.e.

Key Takeaways

A fiber optic bus transmits digital data between devices using light pulses through optical fibers, combining the principles of optical communication with bus network protocols for high-speed, reliable data transfer.

Basic Principle of Fiber Optic Communication

A fiber optic bus relies on optical fiber technology, where data is transmitted as pulses of light through thin strands of glass or plastic. Electrical signals from a device are first converted into light signals using a laser diode or LED. These light pulses travel through the fiber via total internal reflection, which keeps the light confined within the core of the fiber even over long distances.

At the receiving end, a photodetector converts the light pulses back into electrical signals, which are then decoded into usable data. This method provides high bandwidth, low signal attenuation, and immunity to electromagnetic interference, making it ideal for critical applications.

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Fiber Optic Bus in Data Networks

A fiber optic bus applies this optical communication principle to a networked bus architecture, allowing multiple devices (nodes) to communicate over a shared medium. In aerospace and military applications, standards like MIL-STD-1773 and AS1773 define the implementation of fiber optic buses. These standards are derived from the electrical MIL-STD-1553 bus but replace copper wiring with optical fibers while maintaining the same communication protocol.

The AS1773 bus, for example, supports dual data rates of 1 Mbps and 20 Mbps, and uses a star-coupled, dual-redundant configuration to enhance reliability and fault tolerance.

Key Features

Redundancy: Dual buses ensure continuous operation even if one path fails. High-speed transmission: Optical fibers allow higher data rates compared to electrical buses. Radiation tolerance: Fiber optic buses are less susceptible to electromagnetic interference and radiation-induced errors, which is critical in space applications.

Protocol compatibility: Maintains logical protocol heritage from MIL-STD-1553, allowing integration with existing avionics systems.

Applications

Fiber optic buses are widely used in spacecraft, satellites, and high-reliability avionics systems. They transmit telemetry, control signals, and sensor data efficiently over long distances without degradation, supporting complex systems like the Hubble Space Telescope, X-Ray Timing Explorer, and Tropical Rainfall Measuring Mission. In summary, a fiber optic bus combines optical communication technology with bus network protocols to provide a high-speed, reliable, and interference-resistant data transmission system, particularly suited for aerospace and other critical applications.

Article Content

Profibus

The history of PROFIBUS goes back to a publicly promoted plan from Marco Todaro for an association which started in Germany in 1986 and for which 18 companies and institutes devised a master project plan called "fieldbus". The goal was to implement and spread the use of a bit-serial field bus based on the basic requirements of the field device interfaces. For this purpose, member companies agreed to support a common technical concept for production (i.e. discrete or factory automation) and process automation

Optical Fibre Communication: Working Principle,

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How Optical Fibre Communication Works? Fibre-optic communication involves transmitting a signal as light, converting electrical

Fiberoptic Communication System Architectures And Topologies

In the bus topology, a single fiber cable carries the multi-channel optical signal throughout the area of service. Distribution is done by using optical taps or optical couplers, which divert a small

MPTB AS-1773 Fiber Optics Data Bus (FODB) Lessons Learned

The AS1773 is derived from the MIL-STD-1773 fiber optic data bus which operates at a single data rate of 1Mbps. MIL-STD-1773 is the fiber optic equivalent of the all-electrical MIL-STD-1553 bus using the

Handbook – Optical fibres, cables and systems

The simultaneous availability of compact sources and of low-loss optical fibres led to a worldwide effort for developing optical fibre communication systems. The real research phase of fibre-optic

Understanding Fiber Optic Communication System: Working,

It works on the principle of total internal reflection, allowing light to move through the fiber with very little loss. The process kicks off with an electronic input signal, usually digital data (binary 1s

03_E65 Bus Systems

The electrical signal generated by the control unit is converted into an optical signal by an internal transmitter module and sent along the fiber optic bus. The fiber core carries the light beam.

LIN BUS Formulation using Optical Fiber

These sensors may connect using local interface network (LIN). The sensor interfacing of the network is carrying out using copper wired connections for every automobile.

Bus system fibra optica | PDF

It provides an overview of these systems and their roles, as well as examples of how different vehicle functions are controlled and integrated via the bus systems and gateway modules.

OPTICAL FIBER COMMUNICATION

Fibre Optics Material Choice? H.H.Hopkins and N.S.Kapnay in 1950''s used cladding fiber: Good image properties demonstrated for 75 cm long fiber [Nature 173, 39 (1954)]. Application found use in

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Performance Analysis of Bus Topology in Fiber Optic Communication

The performance of bus topology is investigated in presence of optical amplifiers such as Semiconductor Optical Amplifiers (SOA) and Erbium Doped Fiber Amplifier (EDFA) and photodiodes such as PIN

Design of High-Speed and High-Reliability Communication Network

This paper proposes a high-speed and high-reliability communication network based on the FC-AE-1553 optical fiber bus. It adopts a high-reliability dual-redundant switching network topology, designs the

Principles of Optical Fiber Communications

Fiber Optics An optical fiber can be understood as a dielectric waveguide, which operates at optical frequencies. The device or a tube, if bent or if terminated to radiate energy, is called a waveguide, in

Performance Analysis of Bus Topology in Fiber Optic Communication

This research investigates the performance of bus topology in fiber optic communication, focusing on signal quality degradation relative to node count. Using Semiconductor Optical Amplifiers (SOA) and

Fiber Optic Communication System : Basic Elements & Its Working

Basic Elements of a Fiber Optic Communication System For gigabits and beyond gigabits transmission of data, fiber optic communication is the ideal choice. This type of communication is used to transmit

Fiber Optic Communication Networks | Springer Nature Link

In contrast, a fiber-optic-based bus network is more difficult to implement, because there are no low-perturbation optical-tap equivalents to coax taps for efficiently coupling optical signals into

FIBER OPTICAL COMMUNICATIONS (R17A0418)

UNIT I general Optical Fiber communication system, advantages of optical fiber communications. Optical fiber wave guides- Introduction, Ray theory t ansmission, Total Interna Fiber materials, Fiber

PowerPoint Presentation

The bus is a high bandwidth optical fibre which traverses the entire distribution area. Fractions of the optical power on the bus are tapped off to provide a signal to each subscriber.

Related Video Reference

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This video was associated with the source search result. Verify technical details against current product documentation and project requirements.

Additional source notes

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Technical inquiry: https://aboutkitchens.biz/project-desk.html
North American project location: Research Triangle Park, North Carolina, United States

This document is for preliminary research. Verify specifications against current standards, product documentation and project requirements.

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