ClairPLC

Power Line Communication Extenders for Signal Control



Overview

ClairPLC Power Line Communication Extenders utilize High-speed Power Line Communication (HPLC) technology combined with IoT capabilities to transmit traffic signal control signals and monitor their status over two-core power lines. This upgrades traditional star topology power line signal control systems into intelligent bus-network-based control solutions, significantly reducing cabling costs by 70% and shortening installation time by 25%. For older systems where trenching and conduit installation are not feasible, this solution enables the expansion of lighting and equipment without additional cabling.

ClairPLC-Master serves as the primary device for data transmission, collecting signal outputs and RS422/485 data from the traffic controller. It connects to the signal controller's output backplane to acquire traffic light control signals, countdown timer signals, and RS485/RS422 signals for devices like green wave displays. The processor encodes all collected data, which is then superimposed onto the power lines via a carrier module for transmission.

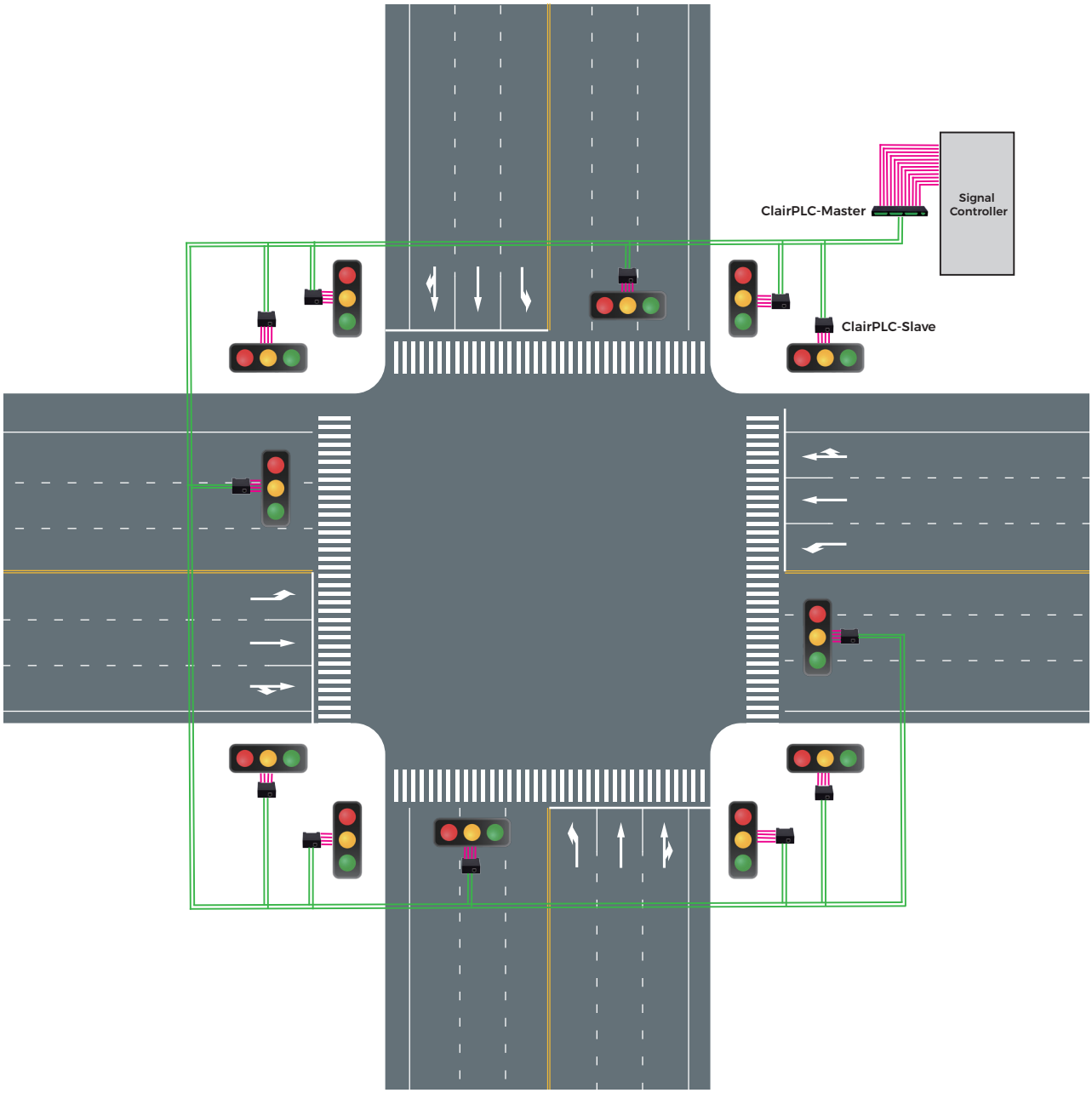


ClairPLC-Master

ClairPLC-Slave, the data transmission receiver, connects to a power line for both power and data access. Using a carrier module, it receives and decodes data from the power line via its processor. Once decoded, it controls the traffic lights and related devices while transmitting data back as needed.



ClairPLC-Slave



Key Features

Reduced Cabling and Construction Costs

- Supports the transmission of multiple data types, including RS485, RS422, and TCP/IP, over power lines.
- Minimizes cable usage, eliminating the need for additional trenching and other civil works.
- Enables the retrofitting and upgrading of old power line infrastructures.
- For new intersections, this technology reduces cable usage by over 70% on average.

High Security and Reliability with Dual Communication Redundancy

- Ensures communication security with advanced encryption methods.
- Automatically destroys sensitive data after passing through isolation and voltage regulation modules.
- Isolates communication within a single intersection for enhanced safety.
- Provides accurate leakage detection for live and neutral wires, minimizing the risk of electrical accidents.

Enhanced Scalability and Compatibility for Traffic Signal Systems

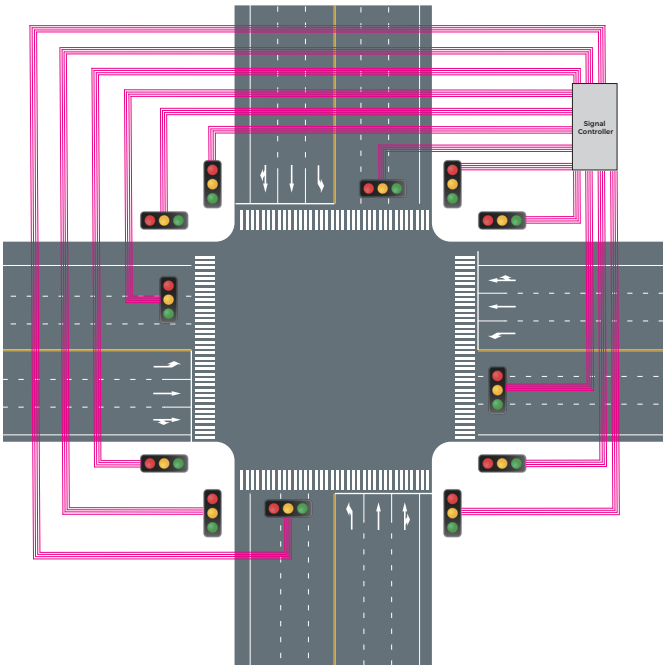
- Supports future advancements in detection and control technologies without requiring new cable installations.
- Introduces a new hardware foundation to create a communication network for end devices without adding additional cables.
- Simplifies system expansion by enabling both power supply and data transmission via the main power bus, ensuring better compatibility with evolving traffic signal systems.

Specification

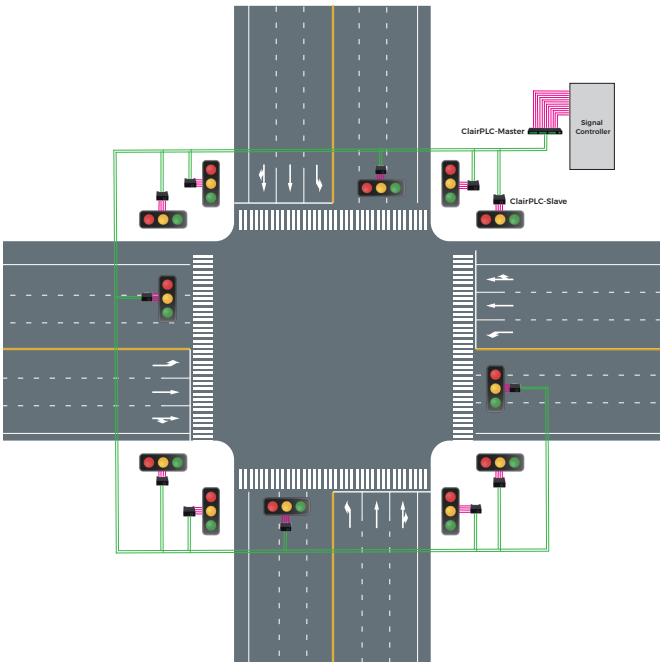
Model	ClairPLC-Master	ClairPLC-Slave
Protocol	Device data transmission utilizes HPLC (High Power Line Communication) technology with AES128 encryption for secure data transfer. Complies with IEEE 1901.1 standard. Uses OFDM technology, supports BPSK and QPSK modulation modes.	Device data transmission utilizes HPLC (High Power Line Communication) technology with AES128 encryption for secure data transfer. Complies with IEEE 1901.1 standard. Uses OFDM technology, supports BPSK and QPSK modulation modes.
Processor	The device adopts an embedded structure with a 32-bit processor.	The device adopts an embedded structure with a 32-bit processor.
Capacity	Equipped with 48 signal status detection terminals, supporting detection of 48 signal outputs from the controller. Maximum number of supported terminals: 255.	Equipped with three separate signal status output terminals for red, yellow, and green lights.
Network Setup Time	Less than 500ms	
Data Transmission Time	Less than 500ms	Less than 500ms
Data Transmission Distance	Up to 3km. In complex signal environments, the device enhances its anti-interference capability by improving the signal-to-noise ratio (SNR), increasing out-of-band rejection, and adding system auto-binding functionality.	Up to 3km. In complex signal environments, the device enhances anti-interference capability by improving the signal-to-noise ratio (SNR), increasing out-of-band rejection, and adding system auto-binding functionality.
Configuration	The device supports configuration of terminal connection links. The device allows remote configuration and firmware upgrades for the terminals.	The device supports configuration by gateway devices. The device allows remote firmware upgrades via the gateway.
Power Supply	Power Supply: 85-265VAC, 50Hz Power Consumption: 5W	Power Supply: 85-265VAC, 50Hz Power Consumption: 1W
Ports	Equipped with 2 RS485 interfaces. Equipped with 1 RS422 interface. Equipped with 1 RJ45 interface.	ClairPLC-Slave-1: 1 RS422 port ClairPLC-Slave-2: 1 RJ45 port ClairPLC-Slave-3: 1 RS485 port
Operating Temperature	-40 to 80°C	-40 to 80°C
Dimension	440x140x40mm	115x80x34mm
Weight	1.76KG	0.33KG

Application

Scenario 1: Two-core wires are used to achieve one-light-one-control functionality.



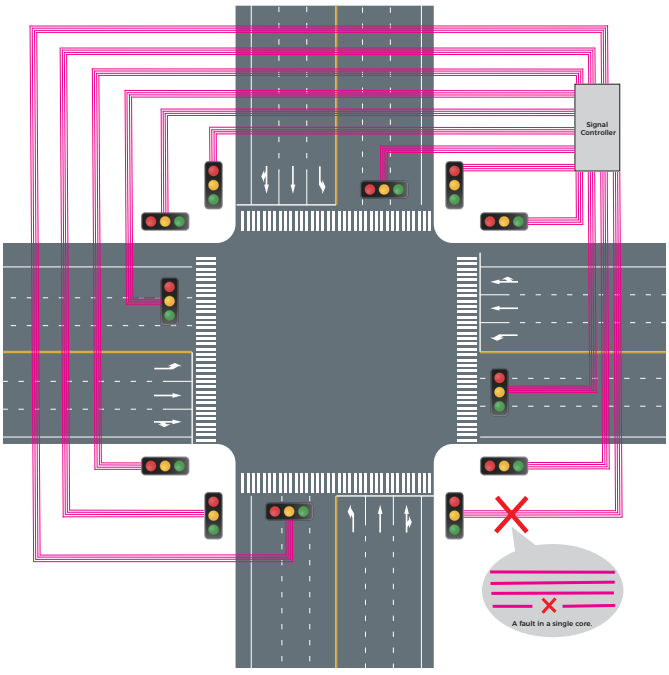
Standard Wiring

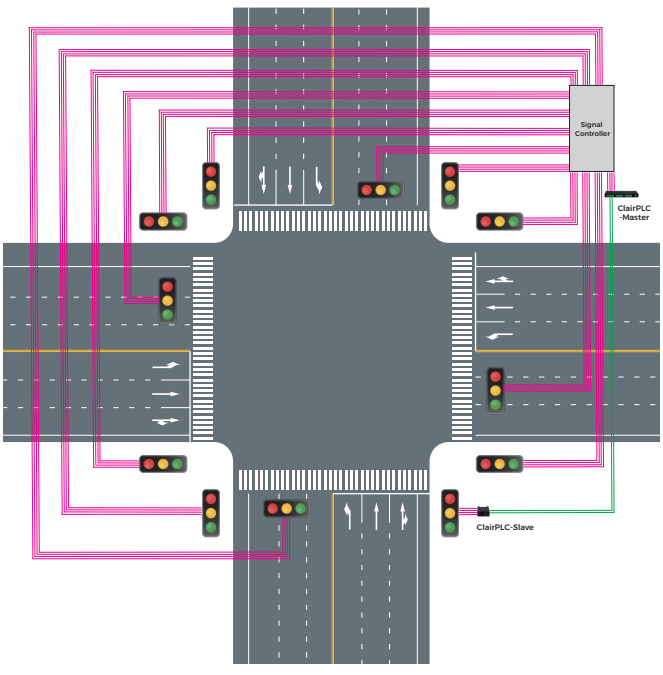


PLC Wiring

1. All signal lights are connected in series using two-core cables, enabling individual control output for each light.
2. By transforming the signal cable wiring from a radial layout to a bus-type layout, the system enables faster installation and significantly reduces cable usage. **Reducing cabling costs by 70% and shortening installation time by 25%.**
3. Achieves individual control of each light, previously only possible with a radial wiring structure.

Scenario 2: The reuse of existing cables enables quick repair of signal light faults.

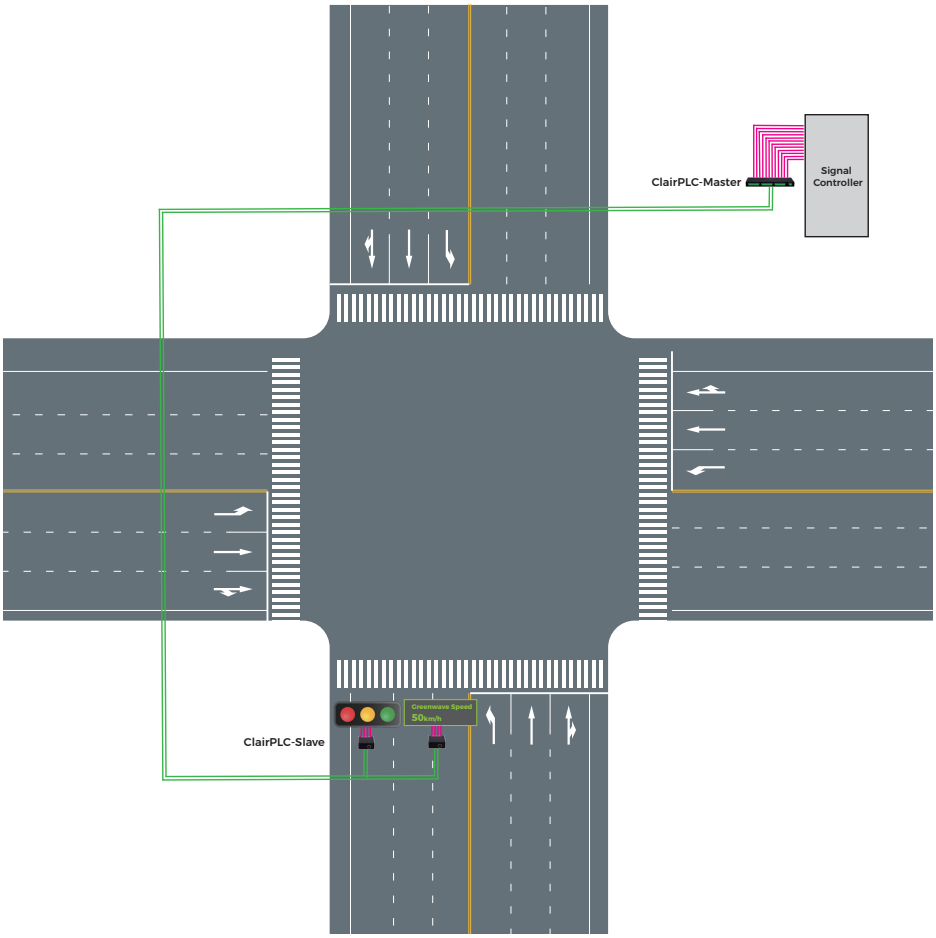




1. A fault in a single core causes the failure of a specific signal light at the intersection.
2. Damage to a conduit in one direction results in the failure of multiple signal lights.

Traditional fault repair methods:
- Temporary wiring (fly lines).
- Slot cutting and laying new cables.
- Re-excavation and repair.

Scenario 3: Reusing existing signal light cables enables data transmission.



By utilizing the two-core cables from the original power supply lines as data communication lines, and adding an ClairPLC-Master unit along with two slave units, the system can parse and identify the corresponding signals of the signal lights. This enables individual control of the green light for straight-through traffic and the collection and publishing of the signal status for green wave control. This method significantly expands the scalability of the signal control system and reduces the hassle of roadwork and construction.

Ordering Information

Model	Description
ClairPLC-Master	The PLC master device supports 2 RS485 interfaces, 1 RS422 interface, and 1 RJ45 interface.
ClairPLC-Slave-422	The PLC Slave device support 1 RS422
ClairPLC-Slave-Eth	The PLC Slave device support 1 RJ45
ClairPLC-Slave-485	The PLC Slave device support 1 RS485