SMART WIRES

PowerLine Coordinator™ v2

The PowerLine Coordinator™ v2 is a rugged and reliable communication device that serves as an intermediary between the SmartValveTM v1.04 devices and the PowerLine Gateway™. It is responsible for managing the fiber-optic link and communication with the PowerLine Gateway for control and status reporting. The communication with PowerLine Gateway is via a proprietary and secure authenticated protocol. The PowerLine Coordinator v2 is a robust and reliable communication device that acts on behalf of PowerLine Gateway to:

- Establish a proprietary/authenticated communication link with the SmartValves
- Commission the SmartValves
- Aggregate data and control of multiple SmartValves
- Cache and reliably transfer a firmware image to the SmartValves as part of the Smart Wires' proprietary firmware upgrade protocol

The PowerLine Coordinator v2 is an important component of the Smart Wires End-to-End (E2E) Communication and Control System that enables the utility to seamlessly commission, observe, control, and maintain the overall SmartValve System.

Front and Rear View of the PowerLine Coordinator v2

Features

General

- Compliant with applicable standards for the Australian, European, South American and North American markets
- Support of multiple fiber optic types for short-range and long-range transmission
- Redundant set fibers
- SFP-based Ethernet redundant uplinks/downlinks to PowerLine Gateway and SmartValves
- Remote firmware upload support via PowerLine Gateway and SmartInterface™

Reliability

- Rugged hardware for substation environment
- No fans or other moving parts
- Supports device and communication redundancy
- Redundant power supplies
- Redundant Ethernet ports

Scalability and Upgradability

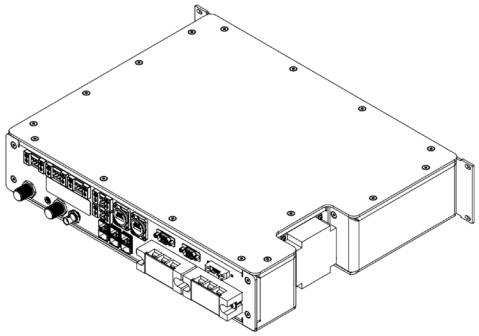
- Supports field-deployment of new features via firmware updates

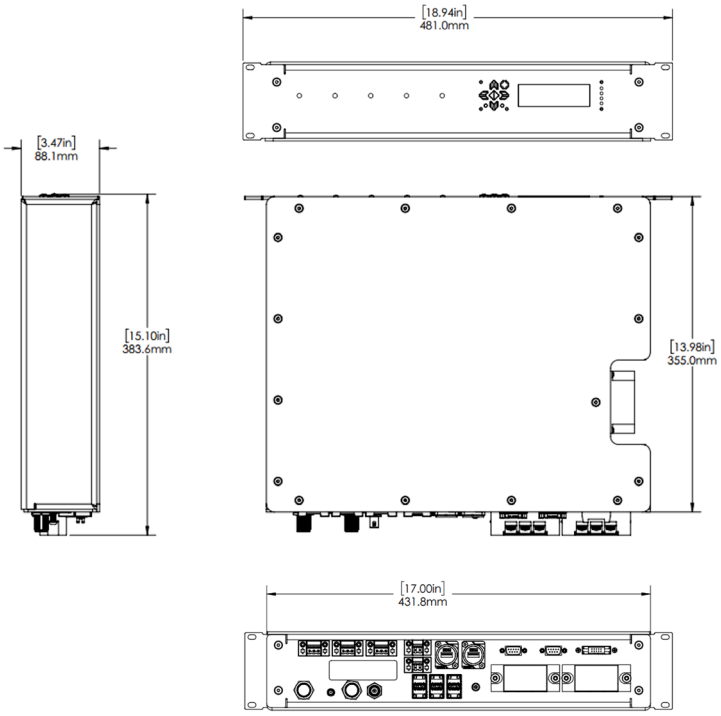
Security

- Packet authentication using HMAC-SHA256 message authentication code
- Supports security on both upstream and downstream communication links
- Authentication process with the PowerLine Gateway based on IEEE 802.11 four-way handshake
- Entire network is time-synchronized with the PowerLine Gateway. The PowerLine Gateway can be synced to a utility time server if needed.

PowerLine Coordinator v2

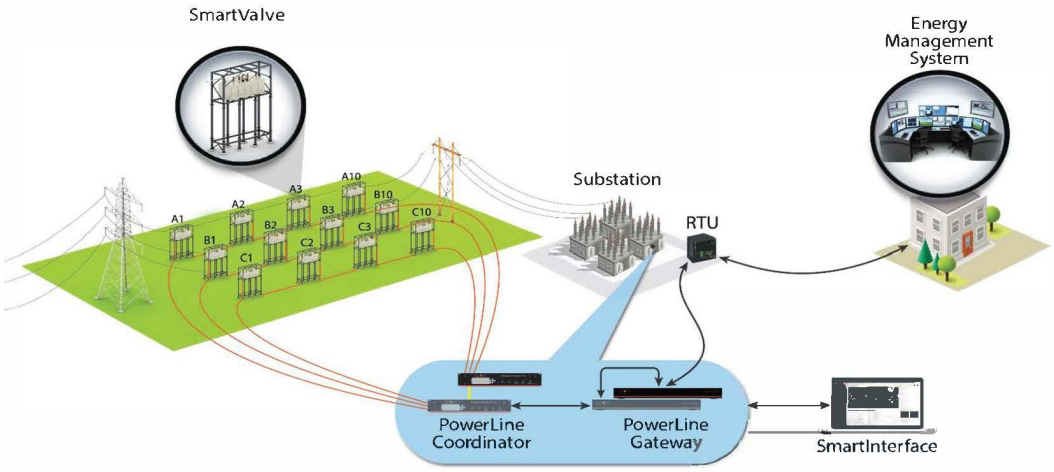
Dimensions





Location

The figure below shows the location of the PowerLine Coordinator v2 relative to the other components of the SmartValve System. The PowerLine Coordinator v2 is typically installed in a substation control house. It uses a fiber-optic channel to communicate with the SmartValves.



Layout of the Components of the SmartValve System

Technical Specifications

Configuration and Management

Commissioning user Interface	Configuration via the SmartInterface utility via direct connection or over a secure network	**Diagnostics**	SmartInterface through the PowerLine Gateway

Security and Redundancy

Communication Security	Multilevel protocol optimized for fast telemetry. Protocol uses keyed SHA 256 HMACs to ensure cryptographic integrity of all messages while supporting full observability by utility firewalls	**Internal Redundancy**	Redundancy on communication ports including redundant fibers and Ethernet ports
System Redundancy	Standard deployment has two PowerLine Coordinator v2 devices. One of them designated as primary and the other as secondary with auto-switchover between the two in case of fault.		

Standard Compliance

General Compliance	Safety (IEC 62368-1),Conducted Immunity (IEC 61000-4-6), Damped Oscillatory Wave Surge (IEC 61000-4-18), Electrical Fast Transient/ Burst (IEC 61000-4-4), Electrostatic Discharge (IEC 61000-4-2), Dielectric Withstand / Insulation Resistance (IR) (IEC 60255-5 Section 6.2.2), Low Frequency Conducted Immunity (IEC 61000-4-16), Radiated Immunity (IEC 61000-4-3), Surge (IEC 61000-4-5), Conducted Emissions (EN 55032)	**Material Compliance**	RoHS2

Input Power[1][2]

DC Variant (P115442)	40 - 160 VDC	**Input Power Requirement**	25 W

Communication Interfaces

Ethernet	6x 1000 Mbps electrical/optical Ethernet ports (selectable by SFP module) with auto MDIX capability	**Serial**	2x RS232 ports with hardware flow control 2x RS485 full-duplex ports

Connection between PowerLine Coordinators	Single connection over fiber or copper SFP to complete the ring communication with SmartValves. Communication done over 1000BASE-SX gigabit Ethernet standard.	**Fiber Connection to the SmartValves**	Three fiber connections to the SmartValves, one per phase
Connection between PowerLine Coordinator and PowerLine Gateway	Single connection over fiber or copper SFP. Communication done over 1000BASE-SX gigabit Ethernet standard.		

Physical

Cooling	Rugged fan-less design	**Mounting**	Standard 19-inch rack-mount (2U)
Mass	13.5 lbs. (6.15 kg)	**Dimensions**	18.94 in. x 3.47 in. x 13.98 in. (481 mm x 88.1 mm x 355 mm) See drawing above
LED Status Indications – Front Panel	Power x2; Comms. x1; Time Sync. x1; System Health x1		

Communication Link Details

Communication Connections	Three LC connectors for communication with SmartValves. Communication with other PowerLine Coordinator and PowerLine Gateway maybe over fiber or copper Ethernet.	**Fiber optic details**	LC connectors with 50/125 µm multi-mode fiber at 800 nm wavelength (770-860). Communication over 1000BASE-SX gigabit Ethernet standard.
Maximum range of fiber-optic transmission	656 ft. (200 m)		

Environmental

Storage Temperature	32 °F to +185 °F (0 °C to +85 °C)	**Operating Temperature**	32 °F to +122 °F (0 °C to +50 °C)
Relative Humidity	5 % to 95 % RH, non-condensing	**Altitude**	Up to 6,561 ft. (2,000 m)
Diagnostic Monitoring	On-board sensors for board temperature and humidity		

SmartValve Compatibility

Capacity	Communicates with up to 21 SmartValve v1.04 per circuit distributed in 1 circuit (7 per phase) and 1 PowerLine Gateway per deployment	**EDR[3] and Telemetry Support**	EDR data and telemetry data from the SmartValves are transmitted via the PowerLine Coordinator to the PowerLine Gateway. Data are stored on the PowerLine Gateway.

Notes:

1. The PowerLine Coordinator uses screw terminals for DC power connections.
2. To accommodate other DC input voltages or AC voltage input, a DC-DC or AC-DC converter can be deployed upstream of the PowerLine Coordinator.
3. EDR stands for Event Data Recorder. Each SmartValve has multiple EDRs to record high-resolution telemetry before and after a trigger event.

SMART WIRES

About Smart Wires

Smart Wires is a leading grid enhancing technology and services provider. We help electric utilities unlock capacity and solve their critical grid issues, using our solutions to create a more flexible, reliable and affordable grid. This enables a faster, more cost-efficient path to meet growing electricity demand with clean energy generation, at lowest cost to consumers. Headquartered in the Research Triangle of North Carolina, Smart Wires has a global workforce of passionate and visionary industry-leading experts across four continents, who work every day to transform grids globally. In collaboration with our customers and partners, we've unlocked over 3.8 Gigawatts capacity—enough to power over 3 million homes—supporting the faster integration of clean energy and new demand, enhancing security of supply and delivering cost savings to consumers.

Together, we are reimagining the grid for net zero.

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