HIGH SPEED
POWER LINE COMMUNICATION PRODUCTS

HELVETIA INC.

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Introduction

Feature of the Power Line Communication (HD-PLC)
**Summary of HD-PLC (Power Line Communication)**

HD-PLC (High Definition - Power Line Communication) standard is technology of overlapping high frequency signal into power-line and wired-line. It is developed by Panasonic.

Other than Power Line (AC / DC), it can use Coax Line, Twisted-Pair Cable!

Communication and power supply can be used with one wire! (possible to supply higher current than Ethernet PoE!)
**Merits of HD-PLC standard**

**Wired Connection**
In the case of wireless, radio wave may not reach. HD-PLC is Wired Connection. It can be stable communication.

**New wiring work is unnecessary**
New wiring construction like drill a hole in the wall high costs. HD-PLC is using existing power line, costs can be reduced!

**High Speed**
HD-PLC can communicate Mbps speed. It can connecting many node, and sending signal for controls is easy.

**Easy Setup**
In the case of WiFi, user is difficulty setting like SSID and password. But HD-PLC is easy by one touch pairing function.

**Power Supply**
HD-PLC can supply high current & voltage more than Ethernet PoE!
Comparison of other PLC standard

The PLC standard is divided into two types, low frequency (kHz) type, and high frequency (MHz) type. HD-PLC is high frequency type.

<table>
<thead>
<tr>
<th>Frequency</th>
<th>Speed</th>
<th>Range</th>
<th>Feature</th>
</tr>
</thead>
<tbody>
<tr>
<td>High Speed PLC (MHz)</td>
<td>High Speed (Mbps)</td>
<td>~1km</td>
<td>• It can sending large data like picture and movie.</td>
</tr>
<tr>
<td></td>
<td>~240Mbps</td>
<td></td>
<td>• Many node connective.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Easy to take timing like control signal.</td>
</tr>
<tr>
<td>Low Speed PLC (kHz)</td>
<td>Low Speed (kbps)</td>
<td>~2km</td>
<td>• it can long range communication more than High speed PLC.</td>
</tr>
<tr>
<td></td>
<td>5~200kbps</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*The communication distance is a value of a guideline in an environment without branching and no load noise.

HD-PLC will contribute to your IoT, EMS, Automation services!!
HD-PLC standard lineup

HD-PLC is depending on your needs, two type of standard are available.

**HD-PLC**

- **Complete**
  - IEEE1901 Compliant HD-PLC Standard
  - Max PHY Rate 240Mbps
  - HD-PLC Complete is performs 1:1 Communication.

- **Multi-hop**
  - HD-PLC Complete is performs 1:1 Communication.
  - Wide area covered by Multi-hop function
  - Covering a wide range by 10-step hopping.

**MegaChips PLC-LSI**

- BlueChip PLC Complete
- BlueChip PLC Multi-hop

**HD-PLC Complete**

- Master
- Terminal
- Terminal
- Terminal

**HD-PLC Multi-hop**

- Master
- Terminal
- Terminal
- Terminal

**Applications**

- Camera
- Smart Meter
- Air Conditioner Control
- LED Lighting Control
- Various Sensor
- Energy Control

Construction of a wide range of networks is possible without wiring work!
**Topology comparison of HD-PLC Complete / Multi-hop**

**【HD-PLC Complete】**
Provide 1:1 high speed communication.

- IEEE1901(PHY & MAC) Compliant
- Maximum effective rate 95Mbps.
- Up to 77 Terminals can be connected.

In one network, 1:1 communication is performed.

**【HD-PLC Multi-hop】**
Provide highly stable communication for industrial applications by multi-hopping function.

- IEEE1901(PHY & MAC) compliant, and it conforms to ITU-T G.9905 as a routing protocol.
  Max 10 step hopping / Max 1024 node connecting
- Maximum effective rate 35Mbps.

If communication can’t be made directly, another node relays and communicates.

Build a network with a tree structure.

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- Surveillance camera
- Elevator
- Power Meter, EMS equipment
- Building automation
- Intercom
- Lighting control
- Construction machine
- Street light control
- Solar panel
- Office equipment
- Construction machine
- Power Meter, EMS equipment
- Building automation
- Intercom
HD-PLC connection example (1)

When connecting HD-PLC, consider the PLC network as the Switching HUB, the image becomes easier.

1. **Ethernet Bridge**

   ![Diagram](diagram1.png)

   It works like an L2 bridge.

2. **Serial-Line Bridge (1/3)**

   ![Diagram](diagram2.png)

   Serial communication is also possible.

3. **Serial-Line Bridge (2/3)**

   ![Diagram](diagram3.png)

   Serial communication can be divided into multiple groups and used.

4. **Serial-Line Bridge (3/3)**

   ![Diagram](diagram4.png)

   Bidirectional communication between serial and Ether is also possible.
If you want to connect multiple PLC network and further expand the scale, like a switching HUB, it can be expanded by using Ethernet Cable. By doing this, it will be possible to communicate with the PLC network.
Compatible with a variety of connection methods

Upstream side is supports power-line, coaxial cable and twisted pair cable, On the downside, it can be input / output of Ethernet, RS-485 and UART. Very easy connection of various devices is possible.
HD-PLC has IP stack available. This enables IP-based communication between the cloud service and each node.

### IP Protocol Stack

<table>
<thead>
<tr>
<th>IP Stack</th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>FTPd</td>
<td>MQTT</td>
<td>UPnP</td>
<td></td>
<td></td>
</tr>
<tr>
<td>DHCPv6c</td>
<td>SSL</td>
<td>HTTPd</td>
<td></td>
<td></td>
</tr>
<tr>
<td>DHCPv4c</td>
<td>DNSc</td>
<td>TELNETd</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>NTPc</td>
<td>TFTPc</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Core Software

| RTOS | CMSR |

#### Hardware

| SERIAL | ETHER | PLC |

- **When not using the IP stack function**
  - It is necessary to have a gateway that converts IP packets into serial signals.

- **When using the IP stack function**
  - Send the IP packet directly to the terminal PLC node. Since the PLC node converts it to a serial signal, the gateway becomes unnecessary.
Point to node when using PLC

Performance may be degraded due to the following factors in PLC communication.

(1) Wiring length
- If the wiring length is long, it will attenuate and communication will be impossible.
- In good environment, communication of several kilometers is possible.

(2) Load noise
- When the load noise exceeds the reception power, it becomes impossible to communicate.
- However, since appliance noise occurs mainly in the kHz band, the MHz band used by HD-PLC has little influence.

(3) Wiring branch
- When there are many wiring branches, it attenuates and communication can’t be performed.

(4) Cross trans
- Communication between single phases is difficult.
- If you want to connect between phases, you can communicate by connecting the PLC network for each phase with an Ethernet cable.

The multi-hopping function provides a stable communication environment, but it is important to install the node in the proper location. Please refer to the guide as reference.
Broad-band Power Line Communication

Helvetia’s HD-PLC Products

[Module]
  HD-PLC Complete : VPLC-CORE100/C
  HD-PLC Multi-hop : VPLC-CORE100/M

[IoT Gateway Adapter]
  HD-PLC Multi-hop : VPLC-1000
In addition to the PLC module, the following boards are also available.

- for AC Power Line Board
- for DC Power Line Board
- for Coaxial Cable Board
- External expansion I/F Board
- Supports external MCU expansion

Feature

- Adopting low power broadband PLC LSI.
- AC and DC power lines corresponds.
- Excellent noise immunity and high reliability control (QoS).
- The multi-hopping version supports hopping up to 10 steps, connecting up to 1024 nodes.
- Maximum rate 240Mbps (PHY)
- By combining this module with customer development board, PLC communication environment is easily realized.
## Helvetia HD-PLC Module Specification

### Feature
- Mounting HD-PLC LSI, SDRAM(128Mbit), Power Line I/F, Flash ROM, Ether PHY
- Support HD-PLC standard (HD-PLC Complete, HD-PLC Multi-hop)
- HD-PLC Complete is up to 77 nodes
- HD-PLC Multi-hop is up to 1024 nodes and 10 step hopping.

### Model Number

<table>
<thead>
<tr>
<th>Support standard</th>
<th>Model Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>HD-PLC Complete</td>
<td>VPLC-CORE100/C</td>
</tr>
<tr>
<td>HD-PLC Multi-hop</td>
<td>VPLC-CORE100/M</td>
</tr>
</tbody>
</table>

### Module Specification

<table>
<thead>
<tr>
<th>PLC</th>
<th>Frequency band</th>
<th>Supply Voltage</th>
<th>Modulation</th>
<th>Power Consumption</th>
<th>Full access</th>
<th>Access method</th>
<th>Encryption</th>
<th>Size</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2-28MHz</td>
<td>1.2, 3.3V</td>
<td>Wavelet OFDM</td>
<td></td>
<td>0.57W (Typ)</td>
<td>CSMA/CA</td>
<td>AES-128bit</td>
<td>70mm × 30mm</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>IEEE1901 full compliant</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>240Mbps (Max PHY Rate)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Reed-Solomon, LDPC-CC</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>GPIO, UART, MII(RMII)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- **HD-PLC LSI, SDRAM(128Mbit), Power Line I/F, Flash ROM, Ether PHY**
- **IEEE1901 full compliant**
- **240Mbps (Max PHY Rate)**
- **Reed-Solomon, LDPC-CC**
- **GPIO, UART, MII(RMII)**
- **70mm × 30mm**
**Helvetia HD-PLC Adapter**

**IoT Gateway Adapter**

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**Feature**

With multi-I/F, multi-protocol that can be customized, IP control of various control devices of the facility is easily realized.

- IP control of various control devices of the facility is easily realized.
- Multi-I/F, Multi-Protocol (Custom correspondence)
- Maximum rate 240Mbps (PHY)
- Excellent noise immunity and high reliability control (QoS).
- Function expansion with MCU board is possible.

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**Model Number**: VPLC-1000

<table>
<thead>
<tr>
<th>Feature</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency band</td>
<td>2-28MHz</td>
</tr>
<tr>
<td>Modulation</td>
<td>Wavelet OFDM</td>
</tr>
<tr>
<td>PHY/MAC</td>
<td>IEEE1901 full compliant</td>
</tr>
<tr>
<td>PHY Rate</td>
<td>240Mbps (Max PHY Rate)</td>
</tr>
<tr>
<td>Error correction</td>
<td>Reed-Solomon, LDPC-CC</td>
</tr>
<tr>
<td>Peripheral I/F</td>
<td>Ether(RJ-45)</td>
</tr>
<tr>
<td>Operating Temp Range</td>
<td>0~+50°C</td>
</tr>
<tr>
<td>Encryption</td>
<td>AES-128bit</td>
</tr>
<tr>
<td>Power Supply Voltage</td>
<td>AC100-240V</td>
</tr>
</tbody>
</table>

**Option**

- **[I/F]**
  - RS-485/422 × 2ch
  - Coax Board
  - 16bit DIO
  - 8bit ADC × 4ch
  - 8bit DAC × 4ch

- **[PoE]**
  - 48V/15.4W

- **[Extension]**
  - 32bit MCU Board
Helvetia HD-PLC Module Tools & Documents

We have tools and documents to be used for product development and evaluation verification. It contributes to the reduction of the burden of development and evaluation.

- **Installation guide**
- **External command reference**
- **Peripheral circuit reference design (BOM, Schematic)**
  - For AC100V/200V
  - For DC24V
  - For Coaxial Cable etc...
- **HD-PLC Network Managing Program**
  - Serial Communication setting, viewing of Network Topology, viewing communication quality (CINR) etc...
Product inquiry

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