

# Broadband Powerline (HD-PLC) Communication

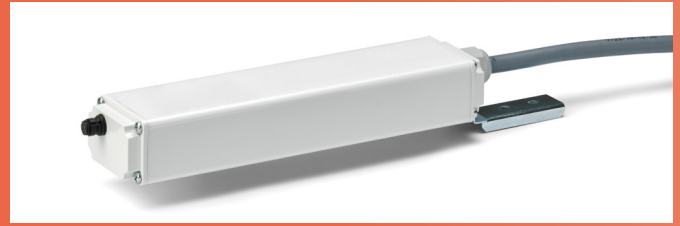
iciti.

Efficient tech for intelligent cities  
Effiziente Technik für intelligente Städte

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## The high-speed talent

iPC-HD - intelligent luminaire controller  
for pole installation of broadband powerline (HD-PLC)  
or simple Ethernet communication



### Powerline - Simple, safe and proven

Powerline technology allows existing power cables to be used for network data transmission- eliminating the need for separate data cables. This is the ideal technology to easily and cost-effectively expand existing lighting installations with a communication network. LVX Global relies on the ISO/IEC 14908 standard, which enables the integration of system components across manufacturers.

### Advantages at a glance

- Communication via the existing mains cables
- Use of the existing street lighting infrastructure
- Easy expansion of luminaire groups
- Field-proven technology from the energy and automation industries
- No disruption of communication due to weather influences or other network interference

### Broadband powerline communication

With High-Definition-Powerline-Communication (HD-PLC), the data transmission takes place via the existing power supply networks.

HD-PLC is used for the transmission of large volumes of data, such as multimedia (voice, image, TV/HD-TV, emergency call) or for the operation of WiFi hotspots and e-charging stations.

HD-PLC uses the frequency range of 2–28 MHz to reliably achieve bidirectional, IP-based high-speed communication at low power consumption with a highly efficient data transmission rate of < 240 MBit/s (gross).

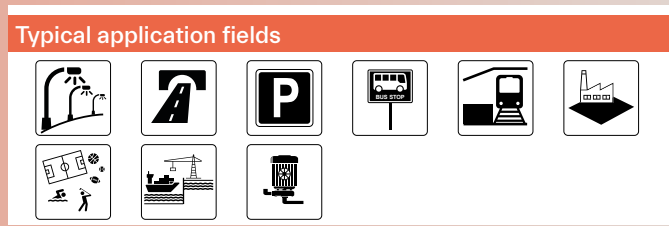
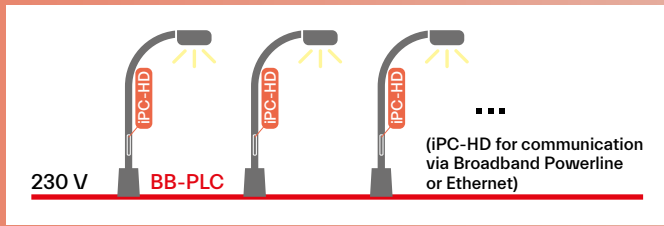
HD-PLC is governed by the HD-PLC Alliance and is internationally standardised according to IEEE1901 and ITU.T G9905. LonMark International has approved the use of HD-PLC for manufacturer-independent communication according to EN 14908 Part 8 (or ANSI/CTA 709.8).

### The high-speed talent

**iPC-HD** - The intelligent luminaire controller with high-speed communication (BB-Powerline) was developed for use in street lighting and lighting close to buildings, works with a standardised high-definition powerline communication and enables the control of electronic control gear with 1–10 V, PWM or DALI interface as well as the use of devices with Ethernet connection via TCP/UDP/IP, such as CCTVs, voice guidance systems, emergency products, advertising boards, support for WiFi access points, etc. Smart city applications benefit from the advantages of IP and LON communication.

Individually programmable and updateable, the controller provides all the functions of a modern light management system and thus ensures a high degree of investment security. It offers the broad spectrum of Smart City applications for the future.





## iPC HD - Intelligent luminaire controller for pole installation

Interoperable luminaire controller according to the OLC LonMark® profile

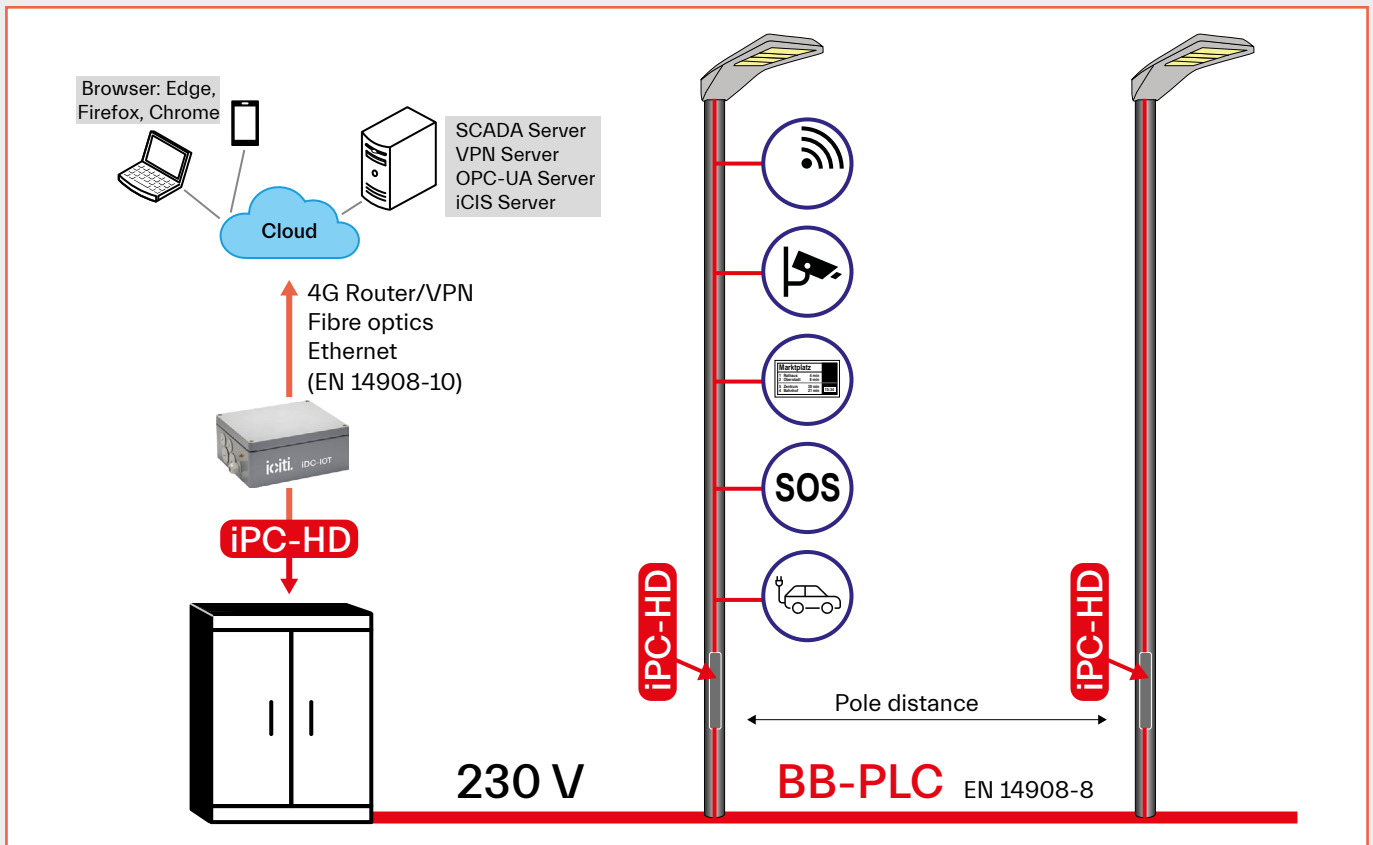
- High-definition powerline communication using the 2–28 MHz broadband
- Power consumption: ~3 W
- High-precision measurement of voltage, current, power factor, power, energy, temperature, illumination hours with very high accuracy
- Connection of various sensors such as motion detectors, key switches and light sensors
- High-speed communication up to 240 Mbps (gross) including 2.5 Mbps independent LON channel
- Ethernet transmission via HD-PLC communication
- Supports up to 10 self-organised repeaters to overcome long communication distances
- The combination of HD-PLC and wireless is possible with the help of an additional router in the pole.

## Typical application fields

- Street lighting
- Tunnel lighting
- Car parks
- Bus and railway stations: bus stops, shunting yards
- Near-building lighting: company premises, warehouses
- Sports facilities
- Port and floodgate facilities
- Pump stations

## Application examples

- On/Off, dimming, RGBW control, diagnosis
- Multimedia, camera, emergency call, announcement, digital information boards
- Charging station for e-bikes and e-cars
- Sensor technology for motion-controlled lighting and traffic-dependent control



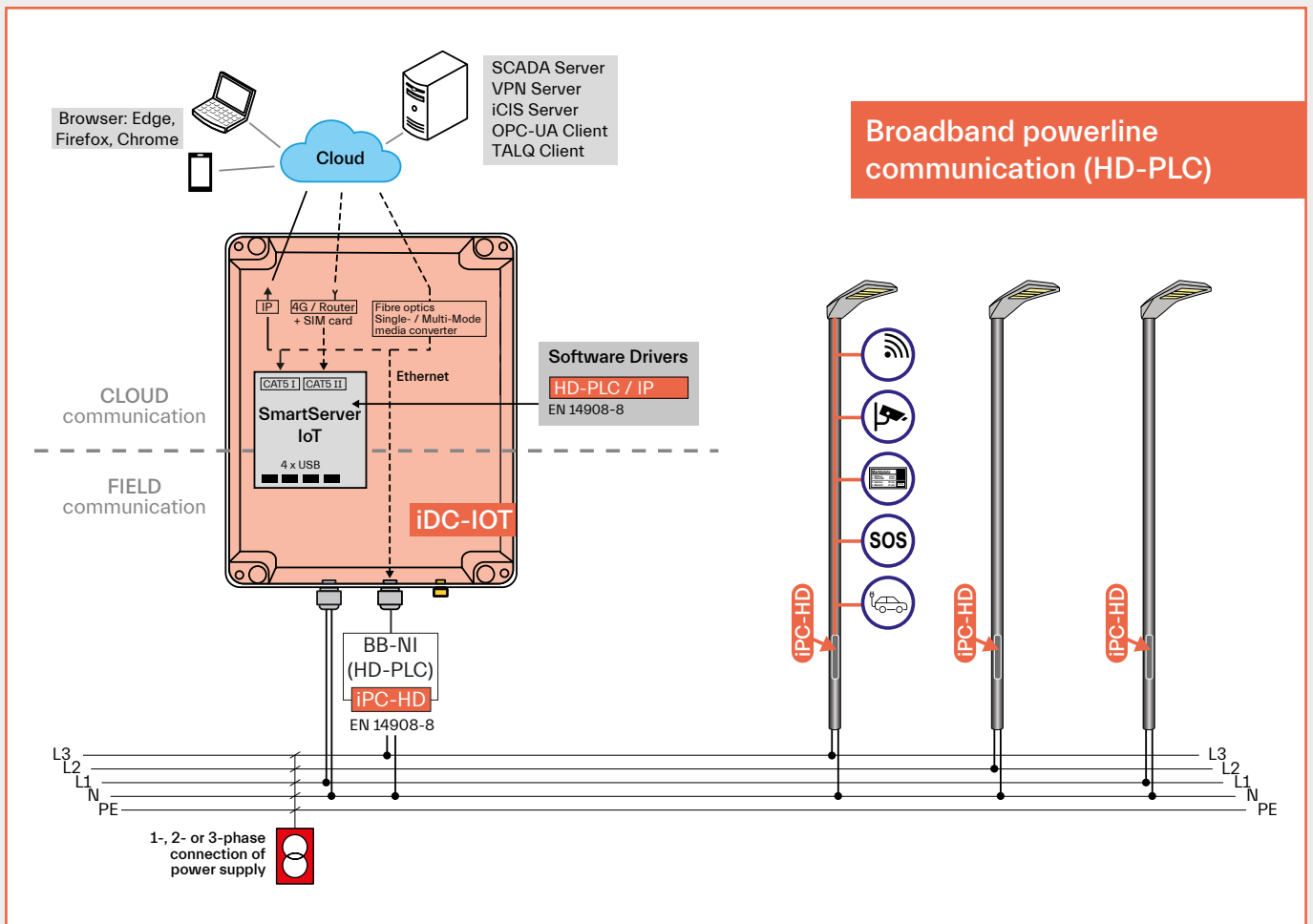


**Products for the implementation of Smart City applications with Broadband Powerline**

- iDC-IOT as edge server
- iPC-HD luminaire controller as broadband interface
- iPC-HD luminaire controller for luminaire pole mounting for various multimedia applications
- iCIS software for the management of Smart City applications

**Notice:**

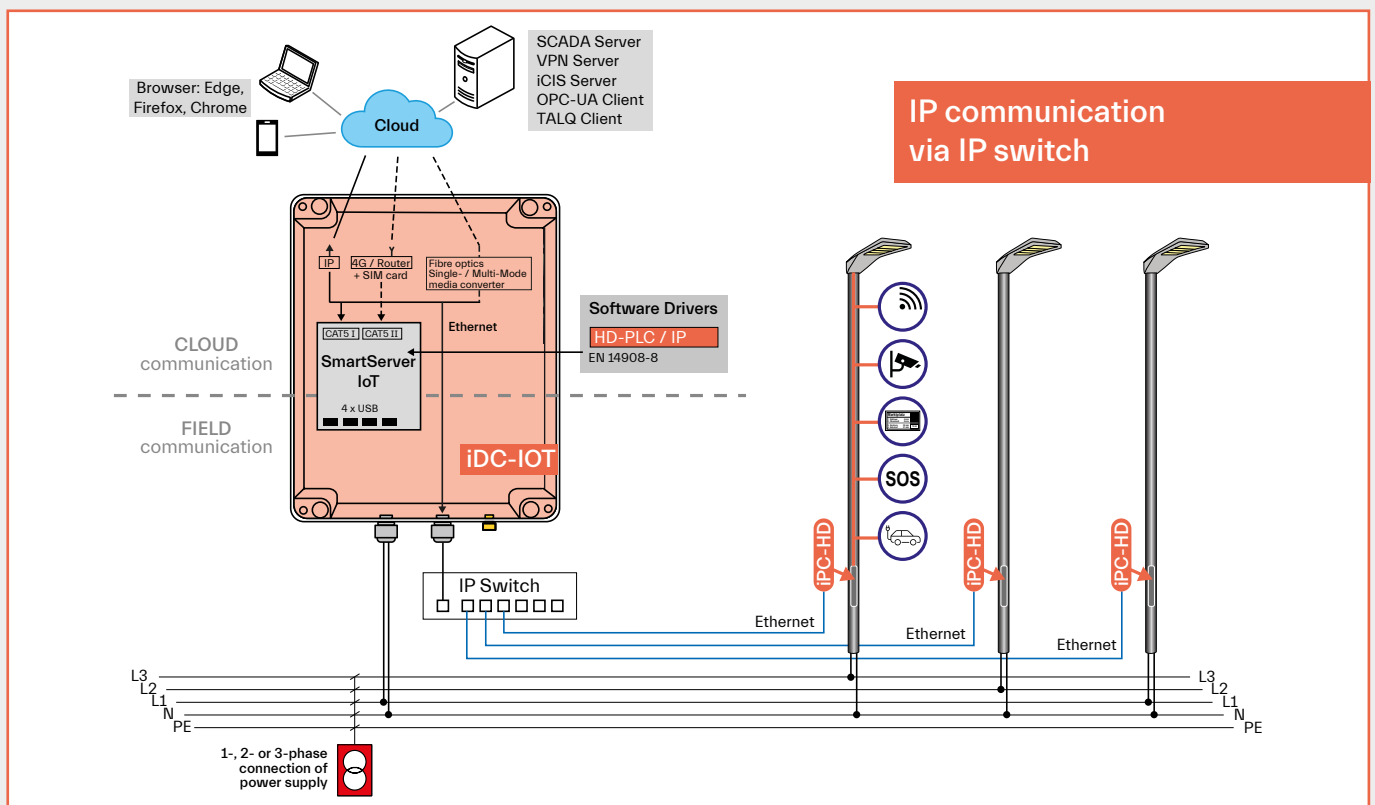
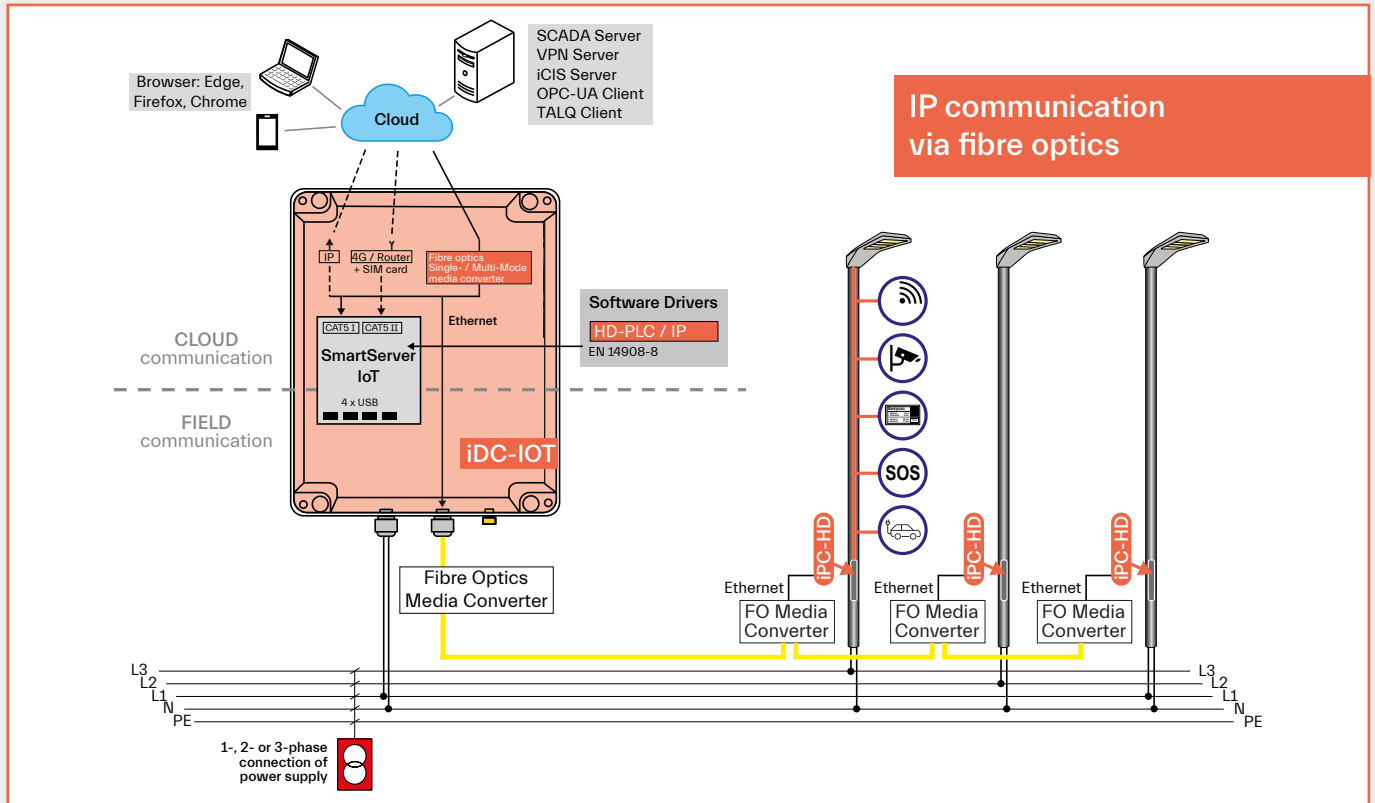
If Smart City applications, i.e. the use of devices with Ethernet connection for communication via TCP/UDP/IP, such as CCTVs, voice guidance systems, emergency products, advertising boards, support of WiFi access points, connection of LoRa etc. are not required, then the standard iLC or iPC controllers with Narrowband-Powerline communication (NB-PLC) can be used.



**Broadband powerline communication (HD-PLC)**

Pure IP communication without Broadband Powerline can be carried out via an IP switch or via fibre optics. The iDC-IOT offers both options.

In the luminaire pole, the iPC-HD controller serves as an Ethernet connection to control the various Smart City applications.

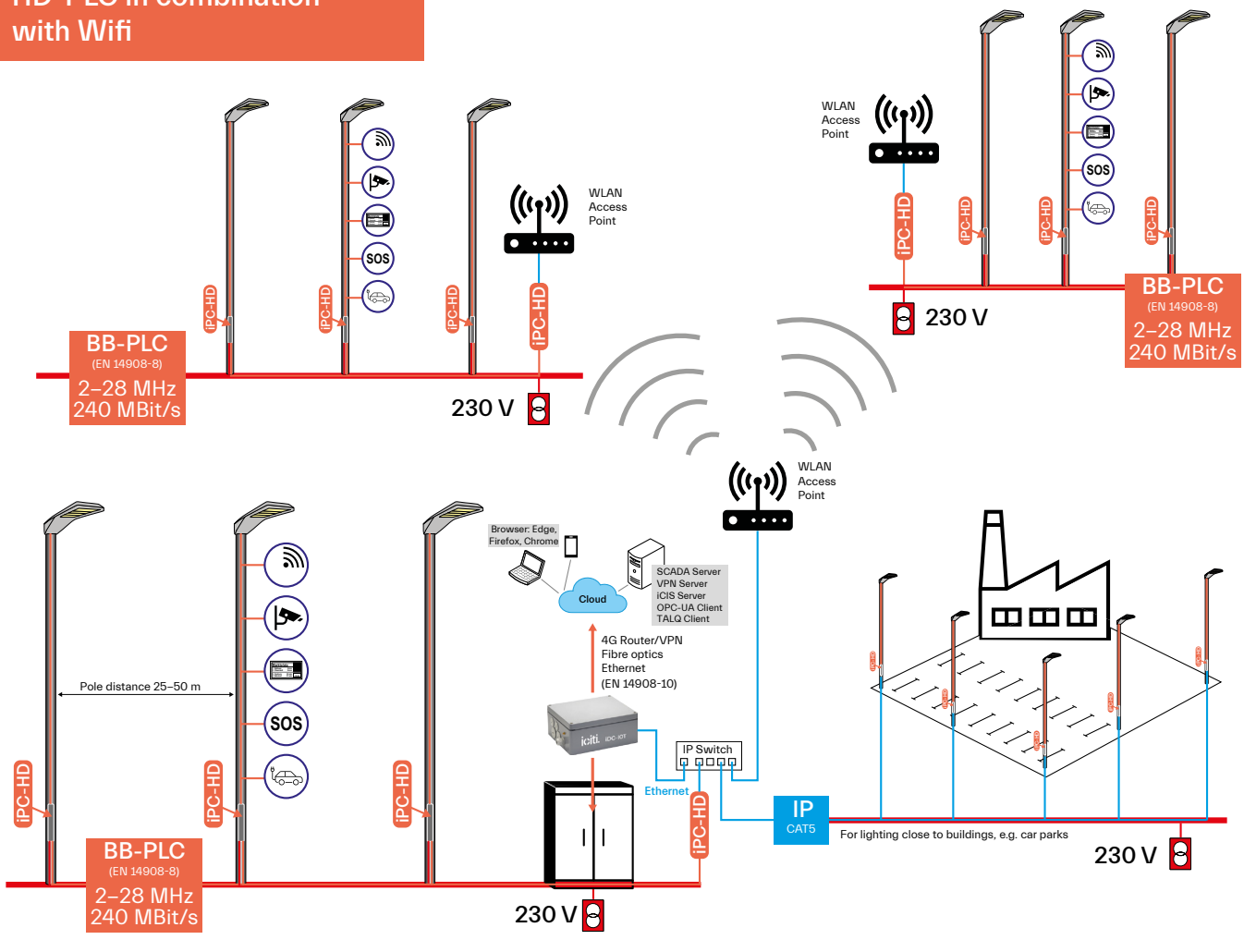


# HD-PLC in combination with other transmission technologies

Broadband Powerline (HD-PLC) can be operated in combination with other communication technologies such as Narrowband powerline and RF-MESH. Data can also be transmitted via Wifi.



## HD-PLC in combination with Wifi



With the help of Wifi, communication can be transferred to independent line segments via an HD-PLC network interface. Here, the iPC-HD controller serves as a network interface.

Distances of up to 100 m can thus be covered between separate lighting sections.

A single iDC-IOT is thus able to manage several separate lighting segments.



The innovative high-frequency RF mesh technology uses a transmission range of 2.4 GHz and can also be integrated into the system via the iARM radio module using the iDC-IOT data concentrator.

The operation of broadband and narrowband powerline is possible without problems in one network segment, as the frequency ranges for these two technologies do not overlap.

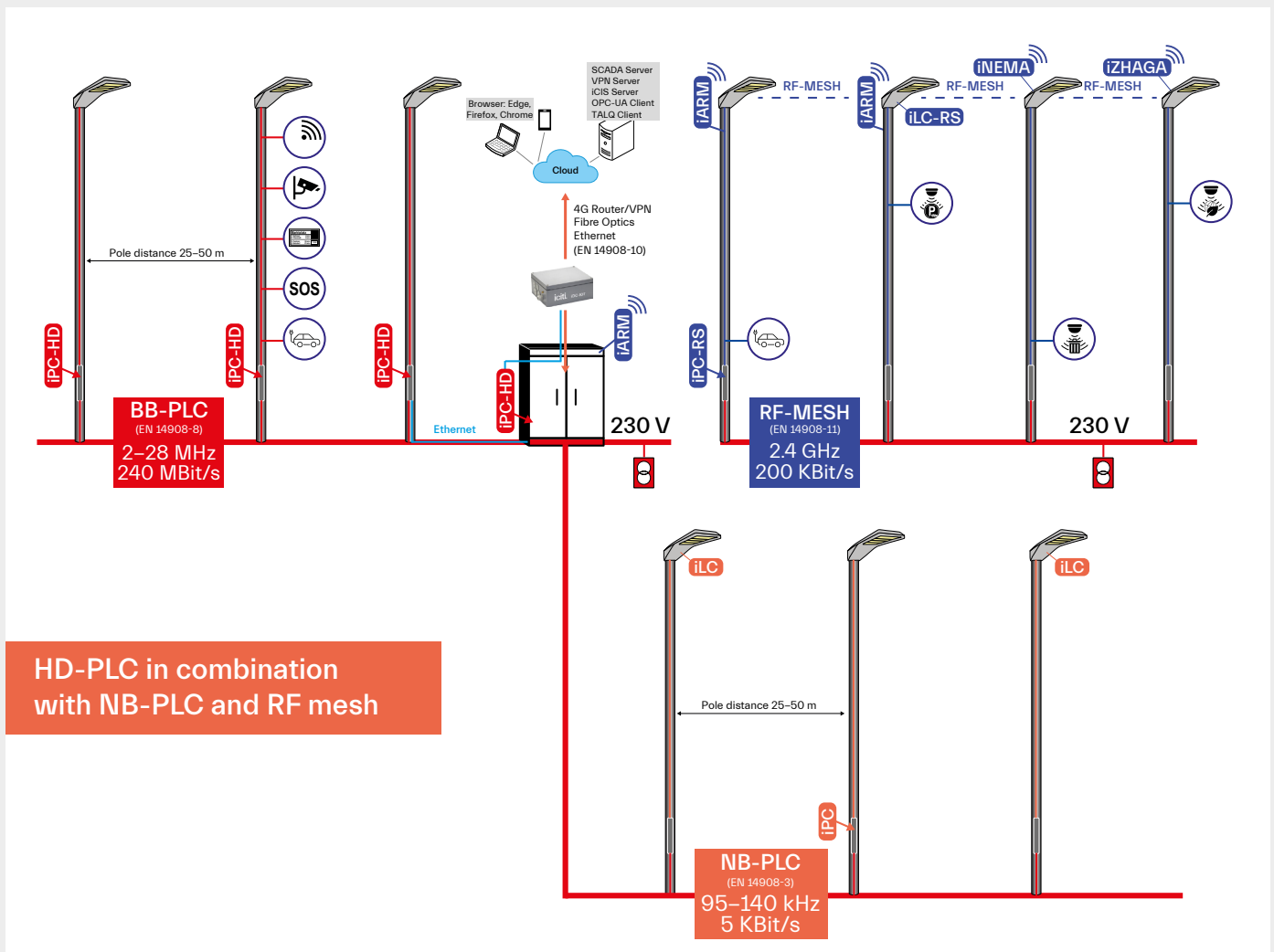
Broadband PLC is transmitted in the frequency range of 2–28 MHz, while narrowband PLC uses the frequency range of 95–140 kHz.

RF mesh is used to communicate in the frequency range of 2.4 GHz over distances of 100 m.

iciti's innovative RF mesh system amplifies the signal 100 times without any loss of bandwidth. This results in a communication distance of 5 to 10 km with a latency of less than 1 second.

Advantages of the iciti RF mesh

- Constant bandwidth over the entire communication path
- Reduction of latency compared to "classic" repeating, due to transmission in a different channel.
- Significantly larger networks can be built.



HD-PLC in combination with NB-PLC and RF mesh

### Requirements

Use of the street lighting infrastructure for additional data-related services. In addition, high-speed communication is needed to control street lighting so that scenes such as moving lights can follow pedestrians, cyclists or even cars.



### Background

Street lighting infrastructure, poles and cables, are ubiquitous assets, typically owned by municipalities or other public owners. Extending the functionality from simply switching on and off or dimming a streetlight to a ubiquitous network, under public control and ownership, gives municipalities the opportunity to improve the safety, attractiveness and quality of life of the city. Furthermore, this data network can be monetised by selling the transport of data.

### iciti solution

The iPC-HD is an ISO/IEC 14908 standardised street lighting controller that uses LON-HD-PLC (ANSI/CTA 709.8 and EN 14908-8) to communicate at high speed over long distances. The Ethernet communication capability makes each street light Ethernet-capable and the street lighting installation a kind of distributed, manageable Ethernet switch throughout neighbourhood.



The Ethernet connection can be used for any type of solution such as WiFi access points, CCTV, edge gateways, car park control, digital signage and anything that requires an IP connection.

The streetlights themselves are controlled via an edge controller, which allows for timed switching, manual operation and communication to the cloud.

## Case Studies - Public WiFi



Ostseebad Heringsdorf

In a small German tourist town on the Baltic Sea, no internet connection was available due to poor 4G and 5G coverage. The municipality decided to use HD-PLC connected street lights to illuminate the dyke. This enabled the distribution of WiFi access points near the sea and increased the attractiveness of the area. HD-PLC is the solution to transmit the data over a long distance of several kilometres and provide sufficient data rates.



Marienberg

In this small German town in Saxony, close to the Czech border, mobile internet access was also quite poor in some places. The use of HD-PLC communicating street light controllers enabled the distribution of WiFi access points. HD-PLC is characterised by its reliable communication and multi-hop technology, which makes it possible to transmit high-speed data even over "old" cables.



The provision of free public internet access for the citizens and visitors increases the attractiveness of this small town.



Even when multiple hops were required due to distance and attenuation from cable quality, the PHY rate was above 80 Mbps for most connections, which is a sufficient data rate for IP-related data services.

## Case Studies - High-speed communication



LED catwalk Berlin | © TU Berlin Department of Lighting Technology

The LED Catwalk ([www.led-laufsteg.de](http://www.led-laufsteg.de)) at the Technical University of Berlin is a lighthouse project that demonstrates the possibilities of high-end lighting controls for energy saving, function and art. Municipalities, schools, suppliers, scientists, planners and citizens can find out what is possible with state-of-the-art street lighting and control.

Over a distance of about 1500 m, more than 70 iPC-HD devices from iciti control several LED luminaires. The need to control the status and colour of a luminaire in a few milliseconds requires a high-speed communication system capable of covering long distances. HD-PLC is the perfect solution for all requirements that are common today in the high-end sector and in the future for street luminaires.

## Tunnel lighting

Tunnels and subways place the highest demands on lighting technology and the implemented light management system. Good and homogeneous illumination increases the attention of vehicle drivers, fewer accidents occur, and road safety is increased.

Road safety can be further increased through the use of sensor technology. Examples of this are an adjustment of the illuminance / luminance values depending on the traffic volume or also information boards that indicate weather-related requirements of the road.

With powerline technology, existing power networks for data transmission can be used to set up a network for data transmission without the need for additional data cables.

HD-PLC can achieve the transmission of large volumes of data as is needed for tunnel applications (voice, image, TV/HD-TV, emergency call).



Tunnel application

### Note:

In addition to pure broadband PLC communication, there is also the option of implementing communication via an IP switch or via fibre optics without HD PLC. Both options are offered by the iDC-IOT. In this case, the iPC-HD controller serves as an Ethernet connection to control the various Smart City applications.



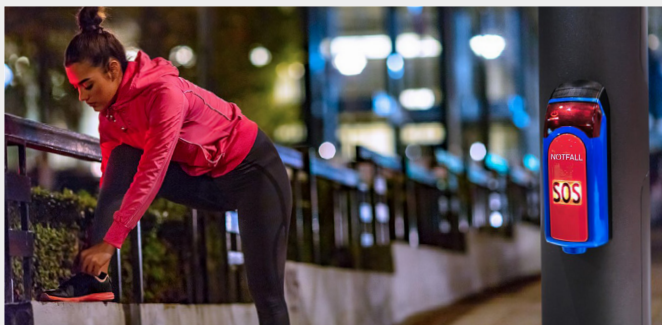
### Camera / Emergency call

In comparison to LTE / 5G, HD-PLC provides the user with a dedicated transmission channel (power supply line) of max. 240 MBit per second.

This transmission path offers sufficient bandwidth to support data streams of a surveillance camera or data transmission for voice.

Since Powerline is a line-based system, the interference-free exclusivity of the transmission channel is a unique selling point and thus an important security aspect in this application area.

In addition, the standardised HD-PLC technology automatically amplifies the signal up to 10 times, which leads to a greater distance in the transmission of communication.

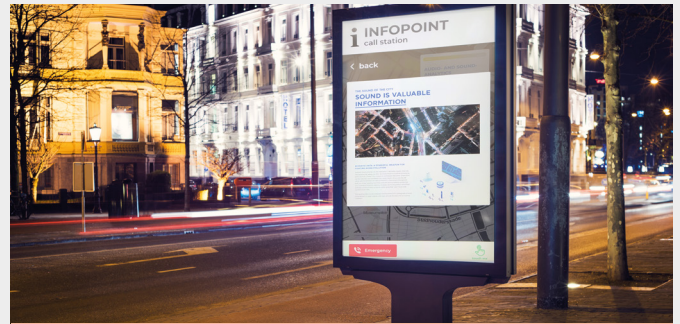


Example: Emergency call

### Digital information boards

The bandwidth of HD-PLC is so large that extensive dynamic data, such as timetable displays, parking guidance systems and moving images can be played out on corresponding displays.

This not only increases the attractiveness of a city, it also leads to additional revenue opportunities through its use as advertising space.



Example: Digital information boards

### Charging stations for e-mobility

In order to support the charging of e-cars and e-bikes via the existing street lighting, the lighting cable must be permanently powered.

The iPC-HD luminaire controller ensures that the street lighting is switched and dimmed independently. The luminaire controller has 10 DALI addresses and can indicate the location of a free charging point remotely via coloured signalling lights, provided the luminaires are equipped with RGB LED modules.

Since the lighting cable is usually not sufficiently dimensioned to provide maximum energy simultaneously at all tapping points, peak load energy management can be achieved via HD-PLC communication.



### Future-proof standard

With LON and LON over HD-PLC (ISO/IEC 14908 or ANSI/CTA 709 series), iciti uses a common standard for outdoor lighting. Customers are not dependent on a single source or tied to a manufacturer-specific solution. In acknowledgement of the long innovation cycles for street lighting infrastructure, HD-PLC meets the requirements for a long service life of public installations by providing long-term stable and future-proof standards.

#### EN 14908; ISO/IEC 14908 (ANSI/CTA 709)

Company-neutral data communication for industrial and building automation and the networked City - Building Network Protocol

- Part 1: Data protocol layer model
- Part 2: Communication via twisted pair cables
- Part 3: Communication via the power supply lines (Narrow Band Powerline) [CENELEC 50065-1] 5 KBit/s
- Part 4: Communication via tunnelling over Internet Protocol (IP) [formerly ANSI/CEA 852]
- Part 5: Implementation
- Part 6: Application elements (description of the standard network (e.g. V, A, T, E ...) and configuration variables as well as functional blocks)
- Part 7: Generic communication via Internet protocols with IPv4 and IPv6, native IP addressing of components
- Part 8: Communication via the power supply lines (Broad Band Powerline) [IEEE 1901] 240 MBit/s
- Part 9: Wireless communication in ISM bands
- Part 10: Web services for SCADA, cloud and peer to peer applications

### Conformity

Of course, all iciti products meet the applicable requirements according to international standards. The HD-PLC standard according to IEEE1901 and ITU.T G9905 ensures cooperativity between other users in the frequency range of 2–28 MHz. Other users such as radio services enjoy priority. The frequencies used by these users are automatically detected by the HD-PLC controller. The HD-PLC controller then masks the use of these frequencies for HD-PLC transmission.

Currently existing requirements for signal field strength, such as those set by Swiss OFCOM, are met by the iPC-HD controller. These requirements are derived from the EN 50561-1 standard, to which the HD-PLC controllers comply.

Through continuous participation in international standardisation bodies, LonMark International and the HD-PLC Alliance, we ensure long-term conformity with all standards relevant to our products.

# PRODUCTS

## intelligent Luminaire Controllers **iLC** and **iPC** – for Narrowband Powerline Communication



OLC-LonMark® profile

- For assembly into luminaires (IP20) or poles (IP65)
- Power consumption: 1 to 3 W
- 10 dimming levels with individual dimming sequences in stand-alone mode, incl. time-delayed on/off switching
- Luminaires can be switched off when connected to a powered lighting cable
- Adjustable control input to suit various tasks
- Connection of various sensors such as motion sensors, key switches and light sensors
- Compensation of reduction in luminous flux with freely definable values for lamp service life as well as start and end levels
- Optionally with audio frequency remote control receiver for migration of existing systems

## intelligent Luminaire Controllers **iPC-HD** – for Broadband Powerline Communication (HD-PLC)



OLC-LonMark® profile

- High-definition powerline communication: 2-28 MHz with up to 240 MBit/s (gross) incl. 2.5 MBit/s independent LON channel
- Power consumption: ~3 W
- Ethernet transmission via HD-PLC communication
- Up to 10 self-organised repeaters to overcome large communication distances
- Connection of various sensors such as motion sensors, key switches and light sensors
- High precision measurement of voltage, current, power factor, output, energy, temperature, lighting hours with very high accuracy

## intelligent Data Concentrator (Edge-Controller) **iDC-IOT**



- Transmission options: 4G router, fibre optics, IP/Ethernet cable
- Connection of the field level via widespread mobile networks of different providers
- For integration into a mobile network, an additional SIM data card is required (not included in the scope of delivery), depending on the application and network size with a data volume of 30 to approx. 300 MB
- In parallel or alternatively, the iDC-IOT can also be integrated into an IP network via a Ethernet cable

## Software **iCIS** and **iCT**



- Standardised light management iCIS
  - Control (on/off, dimming), creation of luminaire groups
  - Support of different LON profiles
  - Graphical processing of measurement data
  - Scheduled switching
  - Data and error analysis
  - Filter option & updates
- iCT – intelligent Commissioning Tool

## Sensors and Infrastructure Accessories



- iLUX – intelligent sensor
- iCCU – intelligent coupling unit
- iPL-NI – intelligent powerline network interface
- iPL-F – intelligent powerline filter

## RF Mesh Products

- iARM - Radio module with antenna for luminaire controller RS
- Luminaire controller for operation with the iARM
  - iLC-RS for assembly in luminaire (IP20)
  - iPC-RS for pole assembly (IP65)
- Luminaire controller with integrated radio module
  - iZHAGA with Zhaga socket
  - iNEMA with Nema socket
- iARM-NI – Network interface for iDC-IOT
- iGATE – Power supply and management for external sensors
- iROUTER – Connection between different communication channels
- Software drivers
  - RF Mesh
  - LoRaWAN

coming soon